



# Malawi National State of the Environment and Outlook

Attaining sustainable development through environmental stewardship

2026



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Malawi Environment Protection Authority  
MEPA House  
Nkhalango Street  
Lilongwe 207213  
Malawi

Tel: +265 986 18 42 92  
Email: [dg@mepa.mw](mailto:dg@mepa.mw)  
Website: <https://www.mepa.mw>

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We regret any errors or omissions that may have been unwittingly made.

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**Cover photo:** Malumbo Simwaka

# Foreword

The Republic of Malawi stands at a decisive moment in its developmental history. As we labour to rebuild our economy and restore the dignity of our people, we must confront the reality that our national aspirations are inseparable from the health of our natural environment and the sustainable utilization of its resources. Our land and soils, our water, and our forests, and all biodiversity and the entire ecosystem are the fundamental assets upon which our sovereignty and our prosperity are built.

This National State of the Environment and Outlook Report (NSEOR) is presented to the nation, not merely as a record of our environmental challenges, but as a strategic instrument for national environmental governance that will ensure sustainable development. For too long, the management of our environment and natural resources has suffered from a lack of scientific evidence and institutional order. The evidence contained in this report confirms that we can no longer treat environmental protection and sustainable utilization of natural resources as an optional endeavor. Environment is the foundation of our existence, the backbone of our development; we need to treat it sustainably for the present and generations to come.

To ensure a resilient Malawi, the Government of Malawi is committed to translating these scientific findings into robust policy actions and strict legal enforcement measures. This report is particularly significant for its forward-looking “Outlook” approach. By analyzing future scenarios, it provides the roadmap necessary to navigate the complex pressures of population growth, climate variability, and industrial expansion. It moves environmental stewardship from the periphery of government business to the very center of national planning and resource allocation. This report is key to the realisation of our goals and targets under Malawi 2063.

I am especially pleased and proud that this document is a product of our own national intellect. Authored by an assembly of distinguished Malawian scientists and coordinated by our environmental regulatory agency, the Malawi Environment Protection Authority (MEPA). The production of this flagship report on environmental matters demonstrates that our institutions possess the technical capacity to solve our own challenges. We have the expertise; what is required now is the collective will to act.

I extend our appreciation to our partners, the Government of Norway, the United Nations Environment Programme (UNEP), and GRID-Arendal, for their technical and financial support in ensuring this work met the international standards.

I call upon all government ministries, departments, and agencies to utilize this report as a primary reference for all development initiatives. Let us work with patriotism and discipline to manage our environment and natural resources in a manner that secures the prosperity of every Malawian, today and for the generations that will follow.



A handwritten signature in black ink, appearing to read 'P. Wiskes', written over a light blue background.

**Honorable Patricia Wiskes, MP**  
**MINISTER OF NATURAL RESOURCES**

# Preface

Since the publication of the previous National State of the Environment and Outlook Report (NSEOR) in 2010, Malawi has made notable progress in strengthening environmental policies and legal frameworks, institutional arrangements, and public awareness. However, as this report clearly demonstrates, pressures on the environment remain significant. Population growth, expanding economic activities, unsustainable land-use practices, and the increasing impacts of climate variability and change continue to exert pressure on land, water, forests, biodiversity, and atmospheric systems. This report represents the Government's continued commitment to comprehensive periodic assessment of the state of the environment, identify key drivers and pressures of environmental change; land and soil resources; freshwater systems; biodiversity; air quality and climate; and the implications of environmental change for human health, livelihoods, and national development. It provides a sound basis for informed decision-making and policy action. Malawi faces both enduring and emerging environmental challenges that have a direct bearing on national development, human wellbeing, and the sustainability of our natural resource base. The trends highlighted in the report, if not adequately addressed, pose serious risks to food security, energy production, economic growth, and social stability of our nation.

In recognition of the need to look beyond the present, this report further presents an outlook analysis based on alternative national scenarios, illustrating how different governance, economic, and policy choices could shape Malawi's environmental future. The scenarios underscore an important message: *the future state of the environment will be determined by the actions we take today*. Strong governance, effective policy implementation, and sustained investment in environmental management have the potential to place the country on a more sustainable and resilient development pathway.

The report further acknowledges existing data and information gaps that constrain effective environmental planning and monitoring, and calls for strengthened data systems, research, and inter-institutional collaboration. It also reviews the effectiveness of current environmental policies and identifies priority options for policy action, aimed at enhancing environmental governance, promoting sustainable resource use, building climate resilience, and improving coordination across sectors.

I wish to express my sincere appreciation to all institutions, experts, and stakeholders who contributed to the preparation of this report through technical analysis, data provision, consultations, and validation processes. Their dedication and professionalism have ensured that the report is credible, relevant, and responsive to national priorities. I expect that this report will serve not only as a reference document, but also as a call to action for Government Ministries, Local Authorities, the Private Sector, Development Partners, Civil Society Organizations, and Communities. The protection and sustainable management of our environment and natural resources is a shared responsibility and a prerequisite for achieving Malawi's long-term development aspirations, as espoused in Malawi 2063, which places Environmental Sustainability as one of the key enablers.



A handwritten signature in black ink, appearing to read 'Misheck Munthali', written in a cursive style.

**Dr. Misheck Munthali**  
**SECRETARY FOR NATURAL RESOURCES**

# Acknowledgements

The Malawi National State of the Environment and Outlook Report (NSEOR) is the result of the collective dedication, technical expertise, and commitment of numerous institutions and individuals who contributed to its development. The Malawi Environment Protection Authority (MEPA) acknowledges with sincere appreciation the invaluable support provided by national and international partners throughout the development process of this report.

MEPA is particularly grateful to the Government of Norway, for providing financial and technical support, through the Norwegian Environment Agency (NEA), under the Energy for Development Programme (Efd). Further appreciation goes to the United Nations Environment Programme (UNEP) and GRID-Arendal for their technical guidance and collaboration in the process. The contributions of the Ministry of Natural Resources [the Environmental Affairs Department (EAD)], other Government Ministries, Departments and Agencies (MDAs), Academic Institutions, Civil Society Organizations, the Private Sector and Development Partners, are also highly acknowledged, for their provision of data, technical inputs, reviews of the document and policy guidance.

MEPA also extends special recognition to the co-chairs of the NSEOR development, Dr. Lucy Mtilatila and Dr. Zacharia Magombo, Coordinating Lead Authors, Lead

Authors, Fellows, Indigenous and Local Knowledge Contributors, Scientific Advisory Group (chaired by Prof. Sosten Chiotha), Government Multi-Stakeholder Advisory Group (Chaired by Dr. Yanira Mtupanyamba), Peer Reviewers, Communication Team and Technical Editors, whose expertise and dedication ensured the scientific integrity, coherence, accuracy and policy relevance of the report. MEPA further acknowledges the essential coordination role played by the Liaison Officers, Assistant Liaison Officers and MEPA Secretariat throughout the writing process of the NSEOR.

The findings of the NSEOR powerfully affirms that safeguarding Malawi's environment is not the work of a single institution, but a united national endeavour that should be built on collaboration and shared responsibility for a sustainable future. The Environment Management Act 19 of 2017 mandates MEPA to be the principal agency for the protection and management of the environment and sustainable utilization of natural resources. Together, let us take bold, decisive actions to protect the environment, reduce climate change impacts, and contribute to the creation of a more just and sustainable nation. A comprehensive list of individuals and institutions that contributed to the preparation of this report is provided in this publication.



**Yanira Mtupanyama, PhD.**  
**BOARD CHAIRPERSON**



**Wilfred Kadewa, PhD.**  
**DIRECTOR GENERAL**

# Table of contents

<b>Foreword</b>	<b>3</b>
<b>Preface</b>	<b>4</b>
<b>Acknowledgements</b>	<b>5</b>
<b>01. Introduction and context</b>	<b>11</b>
1.0 Introduction	11
1.1 Malawi's geography, people and culture	13
1.2 Environmental governance and institutional set up	16
1.3 The 2010 NSEOR Report: Opportunities and challenges	17
1.4 The 2026 Malawi State of the Environment and Outlook Report	17
1.5 Methodology and structure	18
1.5.1 DPSIR Framework	18
1.5.2 Data sources and writing process	22
1.6 Report structure	22
References	23
<b>02. Drivers and pressures of environmental change</b>	<b>24</b>
Executive summary	24
2.0 Introduction	25
2.1 Drivers of environmental change	25
2.1.1 Demographic parameters	25
2.1.2 Economy	26
2.1.3 Technology and innovation	27
2.1.4 Governance	28
2.1.5 Environment and climate change	29
2.1.6 Society, culture, and tradition	30
2.2 Pressures of environmental change	30
2.2.1 Land use and land cover changes	30
2.2.2 Deforestation and land degradation	31
2.2.3 Pollution	33
References	36
<b>03. Land and soil</b>	<b>38</b>
Executive summary	38
3.1 Overview of Malawi's agricultural sector	39
3.2 Land use and land cover change	40
3.3 Land holding sizes, access, and tenure arrangements	43
3.4 Land degradation	43
3.4.1 Mining and land degradation	45
3.4.2 Deforestation and land degradation	47
3.5 Soil health and agricultural productivity	47
3.6 Legal and institutional governance frameworks for land	51
References	52
<b>04. Freshwater state and trends</b>	<b>55</b>
Executive summary	55
4.0 Introduction	55

4.1 Surface water resources and quantity	56
Lakes	58
Rivers	59
Reservoirs	59
Land use change impacts	60
Sediment impacts	60
4.2 Surface water quality	60
4.3 Groundwater resources and quantity	63
4.4 Groundwater quality	64
4.5 Water resources availability and access	66
4.6 Competition for water	67
4.7 Extreme weather events: droughts and floods	69
4.7.1 Droughts	69
4.7.2 Floods	69
4.8 Ecosystem health	70
4.8.1 Human health and ecological linkages	70
4.9 Transboundary water resources	71
4.10 Indigenous and local knowledge for the management of water resources	71
4.11 Catchment management	71
References	73
<b>05. Biodiversity</b>	<b>77</b>
Executive summary	77
5.0 Introduction	77
5.1 The value of Malawi's biodiversity	78
5.1.1 Provisioning services	78
5.1.2 Regulatory services	78
5.1.3 Supporting services	79
5.1.4 Cultural services	79
5.2 Ecosystems of Malawi	80
5.2.1 Terrestrial ecosystems	81
5.2.2 Aquatic ecosystems	83
5.2.3 Agro-ecosystems	85
5.3 Malawi's species diversity	86
5.3.1 Microorganisms	86
5.3.2 Plants	86
5.3.3 Invertebrates	86
5.3.4 Fish	87
5.3.5 Reptiles and amphibians	87
5.3.6 Birds	87
5.3.7 Mammals	88
5.4 Biodiversity issues	89
5.4.1 Data gaps	89
5.4.2 Habitat loss and ecosystem degradation	89
5.4.3 Illegal offtake and trade	91
5.4.4 Human-wildlife conflict	91
5.4.5 Invasive and alien species	91
References	93

<b>06. Air and climate</b>	<b>98</b>
Executive summary	98
6.0 Introduction	99
6.1 Air quality	100
6.1.1 Sources of air pollution in Malawi	100
6.1.2 Indoor and outdoor air pollution	103
6.1.3 Air quality monitoring	105
6.2 Climate	106
6.2.1 The climate crisis landscape in Malawi	107
6.2.2 Exacerbating factors	109
6.2.3 Impacts on society and economy	109
6.2.4 Policy actions and opportunities	112
References	115
<b>07. Implications of environmental change</b>	<b>117</b>
Executive summary	117
7.0 Introduction	117
7.1 Implications for human systems	119
7.1.1. Energy	119
7.1.2. Food security	119
7.1.3. Health	119
7.1.4. Waste management	119
7.1.5. Poverty	119
7.2 Implications for Agenda 2063 targets	119
7.2.1. Agriculture	120
7.2.2. Energy	120
7.2.3. Manufacturing	120
7.2.4. Mining	120
7.2.5. Tourism	120
7.3 Implications for Agenda 2030	121
7.3.1 Zero Hunger and Poverty Alleviation	121
7.3.2. Life on Land and Water	121
7.3.3. Clean Water and Sanitation (SDG 6)	121
7.3.4. Affordable Energy and Clean Energy (SDG 7)	123
7.3.5. Sustainable Cities (SDG 11)	124
7.3.6. Responsible Consumption (SDG 12)	124
7.3.7. SDG 5 on Gender	124
7.4. Implications and the three planetary crises	124
7.4.1. Climate change	125
7.4.2. Nature and biodiversity loss	125
7.4.3. Pollution	125
References	126
<b>08. Data challenges</b>	<b>128</b>
Executive summary	128
8.0 Introduction	129
8.1 Missing data and the data we need	130
8.2 Data availability, accessibility, and clarity	132
8.2.1 Data sharing protocols	133
8.2.2 Data format	135

8.2.3 User capacity	135
<b>8.3 Data quality</b>	<b>136</b>
8.3.1 Methodology	136
8.3.2 Accuracy and timeliness	136
8.3.3 Data inconsistency	137
<b>8.4 Financial constraints</b>	<b>137</b>
<b>8.5 Recommendations and conclusions</b>	<b>138</b>
8.5.1 Short-term recommendations	138
8.5.2 Medium-term recommendations	138
8.5.3 Long-term recommendations	138
References	139
<b>09. Overview of environmental policies and their effectiveness</b>	<b>140</b>
Executive summary	140
<b>9.0 Introduction</b>	<b>141</b>
<b>9.1 Global policy, legal, and institutional frameworks</b>	<b>141</b>
<b>9.2 Regional policy, legal, and institutional frameworks</b>	<b>146</b>
<b>9.3 Overarching policies and institutional frameworks</b>	<b>147</b>
<b>9.4 National policy, legal, and institutional frameworks</b>	<b>150</b>
9.4.1 Overview of land policies	150
9.4.2 Overview of water policies	151
9.4.3 Overview of air and climate policies	153
9.4.4 Overview of biodiversity policies	155
9.4.5 Indigenous and Local Knowledge (ILK) integration into national policy	157
<b>9.5 Institutional frameworks</b>	<b>160</b>
<b>9.6 Effectiveness of current policies</b>	<b>163</b>
9.6.1 Policy complementarity and conflicts	163
<b>9.7 Institutional effectiveness</b>	<b>164</b>
9.7.1 Institutional capacity and coordination	164
<b>9.8 Co-benefits and competitiveness</b>	<b>164</b>
9.8.1 Agroforestry and sustainable agriculture: enhancing soil health and productivity	164
9.8.2 Land policy: promoting tenure security and supporting economic growth	164
9.8.3 Sustainable mining and environmental protection: boosting exports and climate resilience	165
9.8.4 Food security policies: integrating climate resilience and community empowerment	165
9.8.5 Forestry policies: conserving biodiversity and supporting sustainable timber exports	165
<b>9.9 Overbearing policies</b>	<b>165</b>
<b>9.10 Enabling and constraining factors</b>	<b>165</b>
9.10.1 Enabling factors	165
9.10.2 Constraining factors	166
<b>9.11 Conclusion</b>	<b>166</b>
References	167
<b>10. Scenarios</b>	<b>170</b>
Executive summary	170
<b>10.0 Introduction</b>	<b>170</b>
<b>10.1 Drivers of Malawi's future state of the environment</b>	<b>171</b>
<b>10.2 Characterisation of scenarios</b>	<b>171</b>
<b>10.3 Scenario 1 - <i>Business as usual</i></b>	<b>175</b>
10.3.1 Land, soil, and mining	175
10.3.2 Key factors contributing to degradation	175
10.3.3 Projected impacts by 2050	175

10.3.4 Biodiversity	176
10.3.5 Freshwater	179
10.4 Air and climate	181
10.4.1 Maximum temperature	181
10.4.2 Rainfall	183
10.5 Scenario 2 - <i>Policy first</i>	185
10.5.1 Land and soil	185
10.5.2 Biodiversity	185
10.5.3 Freshwater	186
10.5.4 Air and climate	188
10.6 Scenario 3 - <i>Target seeking</i>	190
10.6.1 Land and soil	190
10.6.2 Biodiversity	190
10.6.3 Freshwater	190
10.6.4 Air and climate	194
References	196
<b>11. Options for policy actions</b>	<b>198</b>
Executive summary	198
11.1. Building on the country's aspirations	199
11.1.1 Enhancing the effectiveness of policies	199
11.1.2 Monitoring implementation of policies at all levels	200
11.1.3. Alignment, harmonisation and integration	200
11.1.4. Technological research, innovation and development	201
11.1.5. Integrated policy to incentivize environmental and natural resources management across sectors	201
11.1.6. Smart agricultural practices	202
11.1.7. Land and soil management systems	202
11.1.8. Mining: community development and environmental restoration	203
11.1.8.3. Possible policy actions	203
11.1.9. Mining: environmental impact compensation and resource allocation	203
11.1.10. Fisheries: decline of fish species in Malawi's water bodies	204
11.1.10.1. Issue	204
11.1.11. Incentives for alternative energy: Access and affordability	204
11.2. Improving quality of life	206
11.2.1. Policies for women's empowerment and inclusive development: Access to energy sources.	206
11.2.2. Waste management: recycling, biodegradable materials, and waste-to-energy	206
11.2.3. Food security	207
11.2.4. Food security and health resilience	207
11.3. Leveraging on Malawi's strengths	208
11.3.1. Water availability: Water management systems and incentives for efficient use	208
11.3.2. Indigenous Knowledge Systems	208
11.3.4. Youth as a demographic dividend	209
11.4 Monitoring, evaluation, and learning	210
11.5. Conclusion	210
References	211
<b>Contributions</b>	<b>213</b>



*Photo: Nina Lande.*



# 01

## Introduction and context

**Coordinating Lead Authors:** Bryson Nkhoma, Elizabeth Bandason

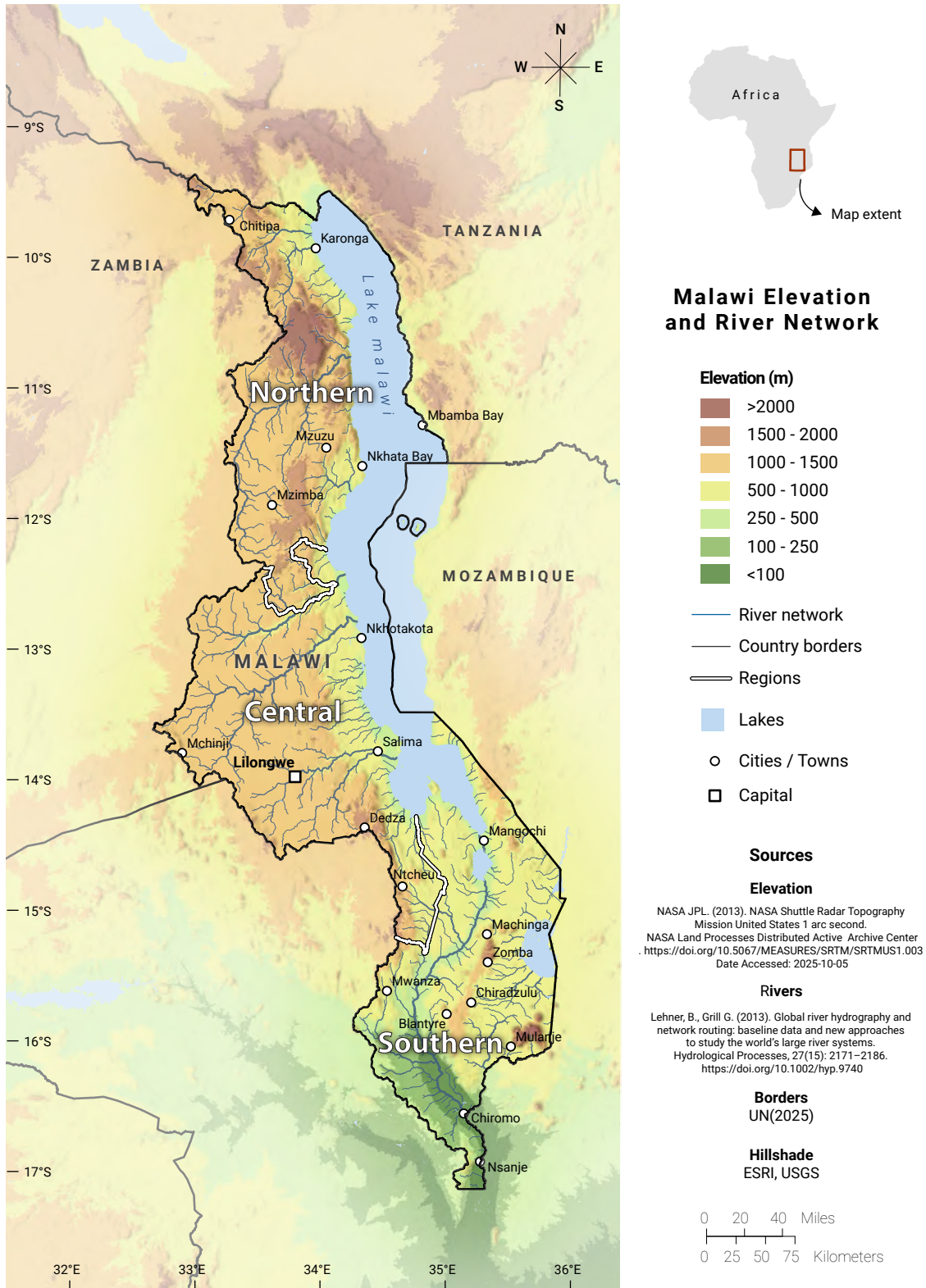
**Lead Author:** Junice Dzonzi, Jean Mtethiwa

**Fellow:** Chiyembekezo Phiri

## 1.0 Introduction

Malawi is in the Great East African Rift Valley and is bordered by Tanzania to the north and northeast, Zambia to the west and Mozambique to the east, south and west. The country is a member state of the Southern African Development Community (SADC), a trade and political

regional community of 16 countries of southern Africa. It is also one of the 21 member states that makes up Africa's largest market for trade and investment in the Common Market for Eastern and Southern Africa (COMESA). The country is landlocked, yet endowed with lakes, rivers, and spectacular highlands (Figure 1.1). Malawi is divided into three regions: northern, central, and southern regions.



**Figure 1.1:** Malawi's topography, regions, and major lakes and rivers.

Malawi is highly dependent on the environment and natural resources for its economic development and for the livelihoods of its people. Meeting the economic needs of 20.7 million Malawians (United Nations Department of Economic and Social Affairs, 2022), without compromising the country's ecological carrying capacity remains a great challenge. Due to inadequate economic opportunities, 90 per cent of the country's population continues to predominantly rely on agricultural production for their livelihoods (World Bank, 2019a). This has resulted in alarming rates of environmental degradation evidenced through deforestation, soil erosion, decreasing soil fertility, water depletion, loss of biodiversity, and increasing pollution (World Bank, 2019a). As development cannot be achieved without environmental sustainability, the Malawi Government is compelled to make informed periodic policy decisions to address environmental and natural resource challenges. These decisions are partly informed by international agreements that Malawi is a signatory to, such as the Montreal Protocol (Kigali Amendment), the Convention on Biological Diversity (CBD), the UN Convention to Combat Desertification, and the Kyoto Protocol.

The 2026 Malawi State of the Environment and Outlook Report (NSEOR) is an integrated assessment of Malawi's state of the environment and the effectiveness of policy responses based on the United Nations Environment Programme (UNEP)'s Integrated Environmental Assessment (IEA) methodology and the Global Environmental Outlook (GEO) style. The report demonstrates the interactions and feedback loops between social, economic, and environmental drivers; assessing how different policy options may help solve natural resource challenges; adapt to rapid population growth and climate change; as well as address difficult environmental issues such as land degradation and biodiversity loss. It calls upon citizens, the government, national and international organisations to apply sustainable development principles to restore the country's valuable natural resources currently facing these challenges.

This report follows the 2010 National State of the Environment Outlook Report which provided government and stakeholders with useful data to stimulate economic growth through sustainable natural resources management as espoused in the Malawi Growth and Development Strategies (MGDS) and the Millennium Development Goals (MDGs). Since the launch of the 2010 NSEOR, the country has undergone pertinent local and global environmental processes, the most significant of which being the adoption of the Environmental Management Act (EMA) of 2017, Malawi Vision 2063 (MW2063), the African Union (AU)'s Agenda 2063, and the United Nations (UN) Agenda 2030 on Sustainable

Development Goals (SDGs). The EMA (2017) compels government to review its state of the environment every five years. The 2026 NSEOR, therefore, responds to these local and global aspirations for achieving sustainable natural resource management. It strives to answer several policy-relevant questions, including:

- a. What is the governance context of the environment in Malawi?
- b. What are the drivers and pressures of environmental changes in Malawi?
- c. What are the current state and trends of the environment in Malawi?
- d. What are the policy responses to these environmental changes and how effective are they?
- e. What is the outlook on the future, and actions that could be taken for a more environmentally sustainable future, thereby linking the past, present and future?

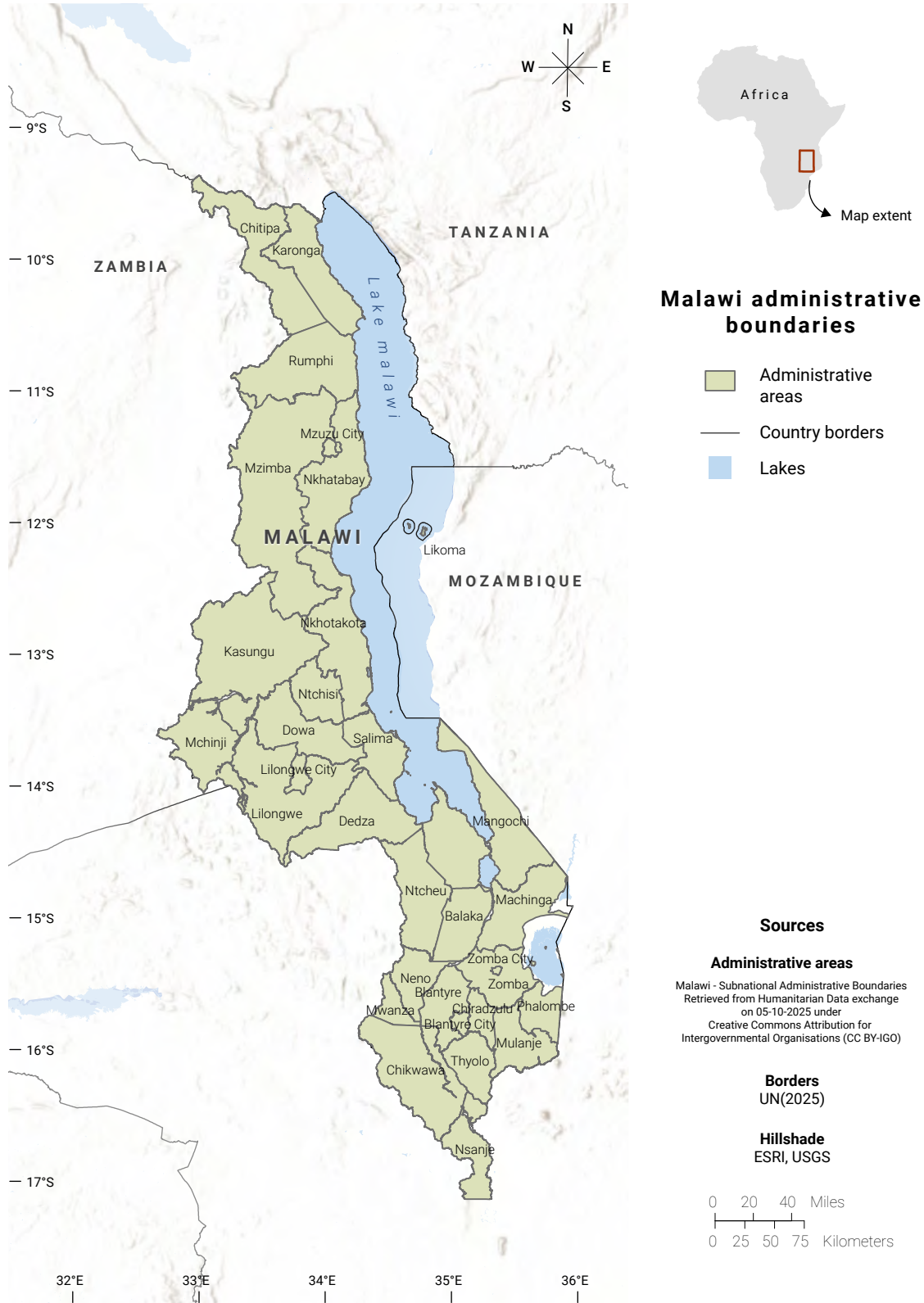
Under the theme 'Attaining Sustainable Development through Environmental Stewardship', this NSEOR responds to these questions by firstly assessing the geographical, cultural, and governance contexts of Malawi as well as the key drivers and pressures that shape the country's state of the environment. Thereafter, the report examines the state and trends of the environment as well as its impact on human and natural systems with respect to land and soil, freshwater, biodiversity, and air and climate. Given the challenges in accessing data in Malawi, the report also discusses data availability. The existing policy landscape is discussed to assess their effectiveness within the broader context of internationally agreed frameworks and methodologies, as well as the extent to which indigenous and local knowledge and practices are applied. The NSEOR ends by painting future environmental outlooks including scenarios to 2050 and options for policy action.

Despite the commendable efforts of various stakeholders to improve the health of the environment, the report observes that Malawi continues to face environmental challenges. One of the key drivers for these challenges is increasing consumption and exploitation of resources due to rapid population growth. In looking ahead, the report calls for a shift from 'business-as-usual scenario' to a 'target-seeking scenario' that integrates local and global targets to achieve both a healthy society and nature. The incorporation of Indigenous and Local Knowledge (ILK) is discussed to foster inclusivity and equity by recognizing the rights and contributions of Indigenous Peoples and Local Communities (IPLCs) as stewards of the environment to enrich the knowledge base as well as inform decision-making.

# 1.1 Malawi's geography, people and culture

Malawi covers a total area of 118,480 square kilometres (FAO 2006) divided into northern, southern, and central regions, with a total of 28 districts (Figure 1.2). Of the total

land mass, 28,760 square kilometres (20 per cent) (GWP Southern Africa 2009) is covered by water bodies, mainly Lake Malawi, Lake Chilwa, Lake Malombe, Lake Kazuni, and Lake Chiuta. Major rivers include Shire, Songwe, South Rukuru, North Rukuru, Dwangwa, Bua, Linthipe, and Ruo.



**Figure 1.2:** Administrative districts of Malawi

Lake Malawi is the largest body of water in the country and the third largest in Africa (Chavula *et al.* 2023). It is also a UNESCO heritage site. Malawi's other important land features are its mountains and plateaus. The highest highland in Malawi is found on Mount Mulanje, with its peak, Sapitwa, standing 3,000 metres above sea level (Malawi National Ecosystems 2022). The mountain is part of the protected forest reserve and home to the unique Mulanje Cedar tree, which is among the country's endangered species. Two other well-known plateaus are found on the Zomba and Nyika mountains. The Nyika Plateau is in northern Malawi and is also a national park with unique wildlife, while the Zomba Plateau presents itself with waterfalls and green vibrant landscapes, where the country's old capital city is located (Mulanje Mountain Conservation Trust, 2026).

Malawi's climate is tropical, with an average annual temperature range between 18°C and 27°C. Since 1971, the country's average temperature has increased by 0.2°C and is projected to increase by 1.03°C by 2040 (from 23.34°C to 23.37°C) and 1.34°C by 2050 (to 23.68°C) (World Bank, 2022). The country's rainfall ranges between 750mm and 2,500mm per year, with Zomba receiving the highest average at 1,433mm, followed by Mzuzu at 1,289mm, Blantyre at 1,127mm, and Lilongwe at 900mm. The country's temperature and rainfall patterns are largely influenced by the Inter-Tropical Convergence Zone (DCCMS 2023).

The country's agricultural sector contributes 30 to 40 per cent of Gross Domestic Product (GDP), 80 to 85 per cent of employment, and 80 to 90 per cent of foreign exchange earnings (International Fund for Agricultural Development 2023). Within the sector, smallholder farmers conduct 95 per cent of agricultural activities (United Nations 2023). The productivity of these farmers is adversely affected by rapid population increase, inadequate land, climate variability, and poverty. For instance, 55 per cent of the smallholder farmer population suffers from poverty, with 22 per cent in absolute poverty. Per capita GDP is US\$381.40, ranking the country 172 on the UN Human Development Index (World Bank 2024). Rural poverty exceeds 65 per cent in some districts. This not only prevents most of the smallholder farmers to afford the much-needed agricultural inputs but also drives them to rely on environmentally harmful livelihoods like poaching, brickmaking, sand mining, selling firewood, and charcoal-making (World Bank, 2022). Second on the economy's drivers are tourism and mining. Between 2026 and 2040, the mining sector could generate a total of US\$30 billion in exports, with annual exports reaching US\$3 billion by 2034, and remain broadly stable over the life of mines (Engel *et al.* 2025).

Malawi's population is composed of diverse ethnic groups including the *Chewa, Tumbuka, Tonga, Lomwe, Yao, Nkhonde, Ngoni, Mang'anja, Sena, Lambya*, and

*Sukwa*. These groups have distinct as well as common beliefs, customs, and practices. Socio-culturally, the *Tumbuka, Tonga, Nkhonde, Ngoni* and *Sukwa*, based in the north, are predominantly organised around a patrilineal socio-cultural system that claims descent and inheritance from the fathers' line. By contrast, and except for the *Sena*, the ethnic groups of the central and southern parts of Malawi follow a matrilineal socio-cultural system that claims descent and inheritance from the mother's line.

These ethnic groups historically integrated their traditions with ecological understandings, conservation practices, and resource management goals, significantly influencing their interaction with the environment. Their relationship with nature is not only cultural but also expresses ecological knowledge systems that guide how local communities manage natural resources sustainably. For instance, traditional agri-ecological practices such as rotational farming, agroforestry, rainmaking and forecasting, and soil conservation techniques are rooted in ecological understanding, and form the country's traditional ecological knowledge. Similarly, many of the ethnic groups have customary rules regulating the use of natural resources, which, if integrated into the country's environmental governance systems, would prevent overexploitation and enhance a more inclusive and sustainable approach to environmental stewardship.

However, there are also some local practices that are harmful to the environment, such as slash and burn cultivation, poaching, and overstocking. The patrilineal and matrilineal socio-cultural context also pose gender-related challenges to environmental local governance. Within the patrilineal society, for instance, land ownership and inheritance are exclusively the domain of men, with the opposite of this scenario being applicable in the matrilineal society. These cultural stipulations have a significant implication on each gender's contribution to environmental management. For instance, men feel less obliged to promote sustainable environmental management in the matrilineal context; just as women do in patrilineal societies.

Malawi was under British colonial rule from 1891 to 1964. As a British colony, the country saw the inflow of western ideas of environmental management and agricultural practices implemented with little regard to local knowledge and history (Nkhoma 2023). The country became independent from the British in 1964 partly as a protest to the colonial disregards of local context to environmental management (Mulwafu 2010). The country transitioned from a one-party state to a multiparty democracy in 1994. This adoption of democracy has had serious implications on environmental governance, with decentralisation and community participation becoming an integral development policy with the potential to enhance good governance, accountability, and environmental sustainability.

It is within this broader geographical, demographic, and socio-cultural context that we need to understand the country's state and trends of the environment and its governance systems. Malawi presents a country rich in natural resources with great potential to stimulate economic growth and sustainable development. Despite this diverse ecosystem, the country faces a lot of pressure emanating from population increase, human activities, and climate change affecting food security, economic development, and livelihoods. Environmental stewardship that integrates local knowledge and practices, environmental sciences and international frameworks is key to the country's realisation of its natural resource potentiality under the present circumstances.

## 1.2 Environmental governance and institutional set up

The Ministry of Natural Resources is the lead institution responsible for environmental affairs. It operates through seven key departments, namely, Department of Environmental Affairs, Department of Climate Change and Meteorological Services, Department of Forestry, Department of Fisheries, Department of Energy, and Department of Mining. Each of these departments is headed by a director supported by regional and district officers. A government agency, the Malawi Environment Protection Authority (MEPA), is the national environmental regulator.

Other government institutions with roles in environmental management include ministries of Lands, Housing and Urban Development; Agriculture, Irrigation and Water Development; Health and Sanitation; Industrialisation, Business, Trade and Tourism; Energy and Mining; and Local Government and Rural Development. The Ministry of Natural Resources provides the primary leadership on environmental matters, but effective environmental management is a collective effort involving multiple ministries and institutions.

The country's environmental mandate is defined in Section 13 of the Malawi Constitution, which outlines the Principles of National Policy. These principles require the government to actively promote the welfare and development of the people by progressively adopting and implementing policies and legislation aimed at achieving key environmental goals. In 1996, the government enacted the first Environmental Management Act to operationalise this constitutional principle by providing the framework for environmental protection and sustainable resource utilisation. The Act was reviewed in 2017 in response to global environmental processes, the most important of which were the UN Agenda 2030 on Sustainable Development Goals (SDGs) and the Sendai Framework for Disaster Risk Reduction, adopted in 2015. These frameworks called for sustainable resource use, climate resilience, disaster risk reduction, and biodiversity

conservation, which are critical for addressing world environmental challenges.

The Environment Management Act of 2017 makes "provision for the protection and management of the environment; the conservation and sustainable utilisation of natural resources and for matters connected therewith and incidental thereto. One of the provisions of the Environment Management Act of 2017 was the establishment of MEPA under Section 7 to serve as a principal agency for the protection and management of the environment and sustainable utilisation of natural resources. The key function of MEPA is to coordinate, monitor, supervise, and consult with all relevant stakeholders on all activities relating to the utilisation and management of the environment and natural resources. The authority advises the Minister on the formulation and implementation of various environmental policies; and initiates legislation, standards and guidelines, including monitoring, enforcement and compliance. It also reviews and approves Environmental and Social Impact Assessments and Strategic Environmental Assessments, as well as prepares and publishes the National State of the Environment and Outlook reports every five years. It is also the mandate of MEPA to promote international and regional cooperation in the protection and management of the environment.

On the global scale, the United Nations published its Sixth Global Environmental Outlook (UN GEO-6) in 2019 which highlighted the urgency of addressing interlinked environmental challenges and achieving SDGs. Responding to the UN GEO-6 call, the Malawi Government operationalized MEPA in 2020 to lead the country towards achieving environmental sustainability. Furthermore, the government developed the Malawi Agenda 2063 in 2021 to guide the country's development. With particular focus on agricultural commercialisation, industrialisation, and urbanization, this development framework is intended to make the country a wealthy, inclusive, and self-reliant middle-income nation by 2063. As the country's long-term strategy, the Malawi Agenda 2063, aligned with the African Union Agenda 2063, underscores environmental sustainability as a critical driver for positive change. Malawi prioritises Sustainable Development (SDG) 6 (Clean Water and Sanitation), SDG 7 (Affordable and Clean Energy), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), SDG 13 (Climate Action), and SDG 15 (Life on Land). By attaching greater importance to environmental sustainability, Malawi seeks to ensure that development programmes are implemented with an ethic of care to avoid further harming the environment. In Enabler 7, the Malawi Agenda 2063 aspires to have 'a safe, clean, secure and sustainable environment' by 'minimizing depletion of natural resources' and fostering sustainable management of the environment such as 'adequate waste management, treatment and recycling, air and water pollution management, and prudent water resources management' (Government of Malawi 2020).

The Malawi Agenda 2063 First 10-Year Implementation Plan (MIP-1) was designed as a strategic roadmap to operationalize the Malawi Agenda 2063 between 2021 and 2030. The MIP-1 outlines concrete strategies, key development priority areas, and a framework for monitoring development progress. To improve the state of Malawi's environment and enhance resilience, the MIP-1 embeds sustainable agriculture and climate-smart practices, promotes investments in renewable energy and reforestation/afforestation, and improves solid waste management. It also fosters sustainable development with environmental protection to secure a healthier environment for the current and future generations. While the country has made such tremendous strides to improve its environmental governance guided by internationally accepted frameworks, it could not effectively implement these changes with the stipulations and guidelines contained in the 2010 NSEOR.

### 1.3 The 2010 NSEOR Report: Opportunities and challenges

Despite other local and global environmental processes, the 2010 National State of the Environment and Outlook Report (NSEOR) remains Malawi's most recent guide to environmental management. The 2010 report is the third in the country's history of environmental assessments and reporting, with the first one rolled out in 1998 through the Department of Environmental Affairs. Published in 2002, the second National State of the Environment, as it was then known, updated the 1998 report by including District State of the Environment Reports. The 2010 report further updated the 2002 NSOER by looking not only at the state of the environment but also future outlooks of the environment. By including outlook reports, the government wanted to provide future options for the country's natural resources using scenarios "based on existing scientific knowledge but adapted different assumptions about how critical uncertainties will unfold to show the range of environmental situations that Malawi may face" (Malawi Department of Environmental Affairs 2010).

The 2010 NSEOR was generally motivated by the desire to inform and influence policy processes with regards to the implementation of the Malawi Growth and Development Strategy (MGDS) and Millenium Development Goals (MDGs) (NSEOR 2010). The report was divided into three parts. The first part dealt with general issues related to environment, people, and development. The issues included environment and economic development; population and human settlements; energy, industry, and mining; and health and the environment, land, and agriculture. The second part focused on the state of the environment with reference to biodiversity, forests, and woodlands; water resources; atmosphere; and climate change. The final part of the report focused on current and future environmental governance.

The key findings of the 2010 NSEOR included the recognition of the existence of high levels of land

degradation and soil erosion attributed to climate change, deforestation, and poor land use which led to biodiversity loss. Moreover, waste management systems were found to be inadequate, leading to increased pollution and health hazards. Rapid urbanization and unplanned urban growth led to most environmental challenges occurring in the urban centres of Blantyre, Lilongwe, and Mzuzu. The report projected four scenarios for Malawi's environment by 2020, namely *Wafawafa* (poor governance and no economic prosperity), *Pendapenda* (good governance but environmentally unstable economic development), *Chonchobe* (economic prosperity and poor governance), and *Mkaka ndi Uchi* (sustainable economic development and good governance). For the country to transform from the first three scenarios (*Wafawafa*, *Pendapenda* and *Chonchobe*), the report recommended improved environmental management through soil conservation, agroforestry, afforestation, climate smart agriculture, urban waste management systems, renewable energy sources, and strengthening environmental governance.

Drawing from the 2010 report, Malawi's government revised some of its policies such as the Land Act of 2016 and introduced environmental mitigation programmes that included mega farms, a plastic ban, Biodiversity Finance Initiative, and National Waters Resources Authority. While the 2010 NSEOR offered a comprehensive evidence-based evaluation of the state of environment, there was limited access to quality data in its development. Its recommendations could have been accompanied with a roadmap for implementation and monitoring. The contribution of indigenous knowledge to environmental governance was left out. Consequently, the country continues to operate at the level of *Pendapenda*.

### 1.4 The 2026 Malawi State of the Environment and Outlook Report

At a workshop on UNEP's Integrated Environmental Assessment methodology in March 2024, stakeholders called for the revision of the 2010 NSEOR by integrating national, regional, and global agendas to align the report with broader sustainability goals. In defining the scope of the 2026 NSEOR, experts highlighted the need to link it with the Malawi Agenda 2063, the Malawi Implementation Plans (MIPS), the African Union (AU) Agenda 2063, and the UN Sustainable Development Goals as well as other regional processes such as SADC protocols on energy and water. The stakeholders associated the country's environmental challenges with unstable economic development which constrained the implementation of existing good policies. There was a clear need for stronger enforcement of these policies to address the challenges posed by institutional capacity and funding constraints, and this included development of a monitoring framework to ensure compliance. A cross-sectional collaboration in implementing the policies, including partnership with NGOs, universities, the private sector, and local communities, was viewed as a must to achieve the desired environmental outcomes. The

general consensus was that the revised NSEOR should use the DPSIR (Drivers-Pressures-State-Impact-Response) framework as espoused in the Sixth Global Environmental Outlook Report.

The 2026 NSEOR assesses the country's state of the environment using the Global Environment Outlook methodology. It examines environmental changes over the past 14 years, focusing on drivers and pressures, state and trends of the environment, and policy effectiveness. The report also presents future scenarios and policy recommendations to guide Malawi towards environmental sustainability and to address extreme climate events like droughts, cyclones, and floods. Aligned with the Environment Management Act of 2017, the assessment strengthens local expertise in environmental analysis and supports key developmental frameworks, including Malawi Agenda 2063 (enabler 7), MIP-1, the AU Agenda 2063, SDGs, and the Sendai Frameworks. This integration underscores environmental sustainability as a catalyst for development and resilience. While aligning to international frameworks is necessary, the report goes beyond by emphasizing the role of indigenous knowledge and local adaptation. This NSEOR is essential for tracking environmental conditions, guiding policy, promoting accountability, and supporting international commitments by identifying areas where action is needed to achieve national developmental goals. It highlights key threats to biodiversity resources, and offers recommendations for sustainable management to ensure long-term environmental stability.

As stipulated in the 2017 Environment Management Act, the 2026 NSEOR calls on MEPA to diligently and consistently review the state of the environment every five years with the view of identifying shortfalls for environmental improvement. The 2026 NSEOR includes several critical outcomes such as policy briefs, stakeholder workshops, education campaigns, summaries for policy makers, integration of environmental education into school curriculum and public awareness campaigns to enhance mindset change on environmental stewardship.

Given Malawi's rapid population growth, and its vulnerability to climate change, the report informs national strategies for adaptation and resilience-building. It also emphasizes on the importance of protecting Malawi's unique ecosystems and endangered species, fostering conservation in biodiversity-rich areas. By providing up-to-date environmental data, the report ensures that policies are evidence-based and targeted at Malawi's most pressing environmental issues.

While the 2010 NSEOR focused on 'environment for sustainable economic growth', the 2026 NSEOR focuses on 'attaining sustainable development through environmental stewardship.' Unlike the 2010 report, this report reinforces the idea that sustainable development must balance economic growth with environmental

protection. This speaks to Malawi Agenda 2063, which fronts environmental sustainability. The report has devoted chapter 8 to data challenges, an element that was not featured in the 2010 NSEOR but is significant for environmental management.

Furthermore, the 2026 NSEOR has three scenarios as opposed to the 2010 NSEOR which presented four scenarios. While maintaining the *Policy First and Business as Usual* scenarios from the 2010 NSEOR, it has reframed *Mkaka ndi Uchi* as *Target Seeking scenario* scenario. The first possible scenario is that of *Business as Usual* whereby, because of the attitude of corruption and unregulated competition for resources, the country would witness sluggish economic development and ineffective environmental governance. The second scenario of *Policy First* describes a situation in which Malawi would experience good governance but with dismal economic growth resulting in unsustainable development. The aspirations in Malawi Agenda 2063 are not achieved. Under *Target Seeking scenario*, Malawi achieves good governance and economic prosperity that would enable environmental sustainability within a generation.

While progressive, Malawi's national policies fall short due to gaps in enforcement, weak institutional frameworks, and lack of coordination across sectors. The 2026 NSEOR recommends institutionalising existing policies, strengthening environmental governance, and integrating climate resilience into national development frameworks through provision of fiscal incentives for renewable energy adoption, promoting afforestation and reforestation, and supporting the private sectors' involvement in green investments. In general, the report considers promotion of renewable energy as a pathway to sustainable development, together with sustainable agricultural practices, efficient water management, and restoration of biodiversity.

## 1.5 Methodology and structure

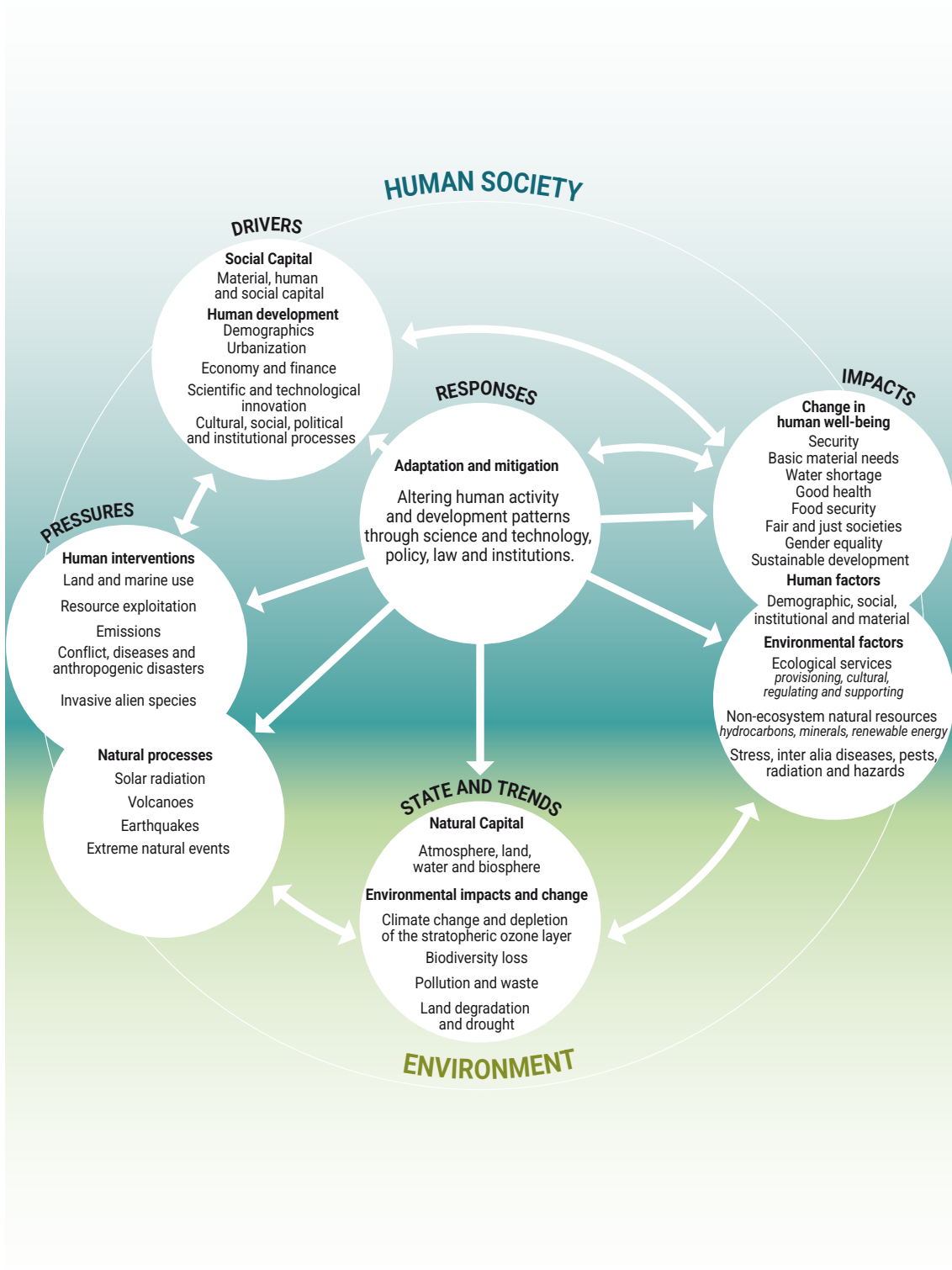
### 1.5.1 DPSIR Framework

Data collection and analysis for the 2026 NSEOR relied on the Integrated Environmental Assessment Methodology and the Drivers-Pressures-State-Impact-Response (DPSIR) framework. The DPSIR framework was developed by the European Environment Agency and the Organization for Economic Cooperation and Development (European Environmental Agency 1999). This framework is significant in understanding environmental change and government responses. Malawian environmental experts and other stakeholders were trained in the application of the framework at a workshop co-organised by UNEP, GRID-Arendal and MEPA. During this workshop, the framework was reviewed for possible adaptation within the Malawian environmental context. As conducted in the GEO-6 and GEO-7 reports, the 2026 NSEOR analyses the drivers and

pressures of environmental change and establishes the state and trends of the environment before looking at policy responses, scenarios, and future environmental

policy options available to bring the country onto the path of environmental sustainability. See Figure 1.3 on the DPSIR illustration.

### Key Elements of the DPSIR Framework Source



Studio ATLANTIS, 2026

Figure 1.3: Key Elements of the DPSIR Framework Source: Scoping Document

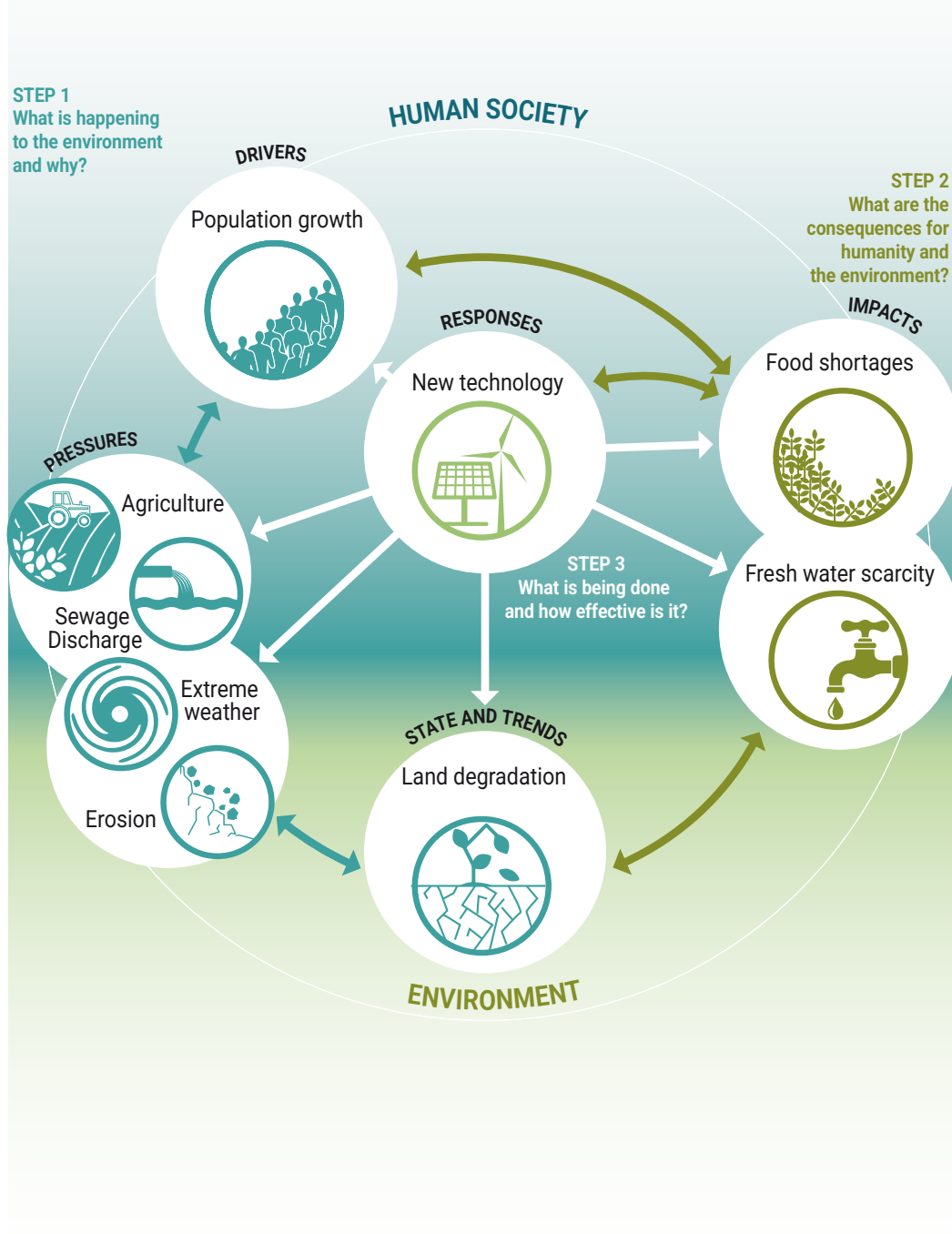
In adapting the framework to the country's environmental context, authors asked three questions:

- What is happening to the environment and why (D-P-S)?
- What are the consequences on the environment and humanity? (I)

- What is being done, and how effective is this? (R).

Figure 1.4 below presents an example that was used during the training showing how the DPSIR was adapted to the Malawian Context through a cause-effect loop.

### DPSIR in the Malawi Context



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**Figure 1.4:** DPSIR in the Malawi Context

### 1.5.2 Data sources and writing process

The 2026 NSEOR adopted a participatory scientific approach taking into account the results from environmental assessments conducted by individuals, institutions, and international organizations, while not duplicating their analysis. These assessment reports provided informed evidence of the report's results.<sup>1</sup> The data was synthesized and analysed to produce the states, trends and scenarios. The interdependencies within and across energy, food and materials/waste systems, and their interlinkages with climate change, human health, gender and youth were then identified. Finally, the analysis considered the sectors and provisioning functions that are most directly dependent on the environment such as forestry, agriculture, fisheries, industry and commerce, tourism, energy and mining.

In assessing the environment, the 2026 NSEOR incorporated Indigenous and Local Knowledge. This approach aligns with global commitments such as the Kunming-Montreal Global Biodiversity Framework that emphasises the importance of integrating diverse knowledge systems to bring about transformative change. The draft Malawi National Biodiversity Strategy and Action Plan (NBSAP) also requires the harnessing of innovations and practices of local communities in environmental management by 2025. The report addresses complex environmental challenges taking into equation cultural heritage drawn from citizen scientists and the UNESCO recommendations on open and citizen science.

The process started with a scoping workshop in which experts reviewed the DPSIR framework to ascertain its applicability in the Malawi context. An initiation workshop was held with identified authors for briefing and task

allocation. The first order draft was prepared and reviewed before producing the second order draft. Before preparing the second order draft authors were assembled again to discuss reviewers' overall concerns on messaging and statistical consistencies between state and trends chapters and those on policy and outlooks.

### 1.6 Report structure

The Drivers-Pressures-State-Impact-Response (DPSIR) framework guided the structuring of the report, that was parted into four parts. The first part provides the context and general overview of the whole report in two chapters. Chapter 1 introduces the report by outlining its background, context, objectives, and methodology. Chapter 2 assesses the drivers and pressures of environmental change, including demographic parameters, the economy, science and technology, political and institutional process, climate change and cultural practices, land use and land cover changes, deforestation and land degradation, diseases and anthropogenic disasters, and pollution. In the second part, the 2026 NSEOR examines the state and trends of the environment with particular reference to land and soil, freshwater, biodiversity, and air and climate. Chapter 7 reports on data challenges that authors faced in the process of assessing and reporting the state of the environment. The third part of the 2026 NSEOR discusses the role of the environment in achieving developmental goals such as SDGs in chapter 8. It also discusses policy responses and assesses their effectiveness in chapter 9. In the fourth section, the 2026 NSEOR provides the country's environmental outlook, suggesting possible pathways towards environmental sustainability. It begins with Chapter 10, which outlines scenarios, and ends with chapter 11, which gives options for policy actions.



Malawi encourages nature positive solutions in addressing its environmental challenges. Photo: Marisol Soledad Estrella

<sup>1</sup> Some of the assessment reports and peer reviewed works consulted included Bass *et al.* 2011; Chavula *et al.* 2017; World Bank 2019b; World Bank 2022, and LUANAR (2023) 'Malawi National Ecosystem Assessment Report' (Washington DC: The World Bank).

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Photo: Horst Vogel.



# 02 Drivers and pressures of environmental change

**Coordinating Lead Authors:** Dyson Moses, Judith Kamoto

**Lead Authors:** Patricia Gomani, Samuel Gama

**Fellow:** Aimloss Greyfield Banda

## Executive summary

**Malawi faces challenges related to environmental change** (*well established*). This chapter addresses two sets of causes of environmental change, namely drivers of environmental change, and pressures on the environment. The chapter also articulates the role that the environment plays in promoting development and in supporting livelihoods. Demographic parameters such as high fertility rate, increasing life expectancy, and migration are leading to population growth and increased consumption patterns for food, water, and energy. Economic hardship, climate change, and political and institutional processes are other key underlying drivers identified behind the pressures exerted on the environment. {2.0}

**The increase in population growth is leading to a steady rise in average population density per square kilometre from 157 people in 2010, to 207 people in 2020 and 230 people in 2024, implying that areas that were sparsely occupied are getting more populated** (*well established*). As settlements expand into forested areas, this is leading to deforestation. About 90 per cent of the population relies on agriculture and over 80 per cent of the population depends on rain-fed agriculture, which is more vulnerable to climate change and variability, hence affecting the economy of Malawi. This vulnerability of the agrarian economy due to climate variability is evidenced by the decrease in GDP growth rate from 6.9 per cent in 2010, 5.7 per cent in 2014, to 3.2 per cent in 2024. {2.1.1}

**Although mining has been identified as one of the pillars for sustainable development in Malawi Agenda 2063 (MW2063), its contribution to the economy remains too low to significantly impact the national budget and poverty alleviation. Energy demands from mining are high in a country already struggling to meet its energy needs** (*established but incomplete*). The mining sector's contribution to the economy declined from 10.8 per cent in 2010 to the present 0.7 per cent when the country's largest

mine, Kayelekera Uranium Mine, was in operation before closing and reopening again. The country is witnessing a surge in artisanal and small-scale mining, especially for gold, in various parts of the country which is bringing about several negative environmental impacts including land degradation.

**The Government of Malawi has a great commitment to a transformational development agenda anchored on MW2063 and its first 10-year Implementation Plan (MIP-1) to advance environmentally sustainable and inclusive growth and achieving most of the Sustainable Development Goals (SDGs)** (*well established*). Lack of political will, poor coordination among ministry departments and agencies, and corruption create bottlenecks in the implementation of environmentally friendly strategies. Long-term shifts in weather conditions, persisting for extended periods, typically decades or longer, are partly attributed to the slow uptake of environmentally friendly energy alternatives. As of 2023, 96 per cent of domestic energy use for cooking was from biofuel, causing environmental damage through deforestation. About 3 per cent of domestic energy use is from solar and hydropower, while 1 per cent is from coal. High rates of deforestation have made Malawi more vulnerable to the impact of hazards such as floods, droughts, cyclones, and landslides. {2.1.4}

**Pollution, changes in land use and land cover, deforestation, and land degradation exacerbate the impact of climate change and variability in Malawi** (*established but incomplete*). Deforestation is responsible for the loss of 250,000 hectares of forest per year largely to growing demand for land for agriculture. The increasing demand for charcoal and firewood, which dominate Malawi's energy mix, result in land use change, among other environmental pressures.



Solar power is a significant alternative energy solution for Malawi. Photo: Sadhika Sasiprabhu.

## 2.0 Introduction

Like many other developing countries, Malawi faces significant challenges related to environmental change. The challenges are complex and interrelated. Population growth, economic hardship, low uptake of technology, governance, climate change, and socio-cultural factors are key underlying drivers behind the pressures exerted on the environment.

In the country, central to the drivers of environmental change is the increase in the demand, consumption, and use of resources such as land, water, and forest resources leading to various pressures on the environment. These pressures include land use change, deforestation, pollution, and waste generation.



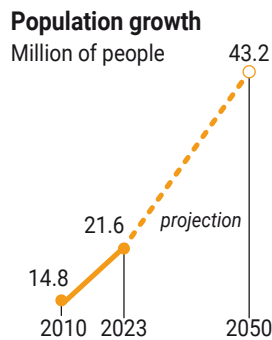
Most of Malawi's urban areas lack the capacity for adequate waste collection. Photo: Helle Bisethjpege

Drivers and pressures of environmental change are complex and interrelated. They determine Malawi's path towards sustainable development. Increasing and changing consumption patterns affect the state of the environment.

# DRIVERS

## Demography

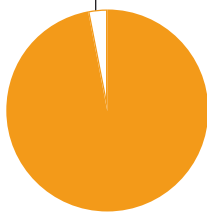
Rapid population growth in Malawi has led to consumption rates happening faster than the environment can handle. Using and disposing of natural resources has never been higher, leading to deforestation, water scarcity and pollution.



## Slow Uptake of Scientific and Technological Innovation

### Energy mix

Clean sources 3%



Despite adopting a renewable energy strategy in 2018, Malawi's energy mix remains dominated by biofuels and charcoal.

The slow adoption of green technologies and limited waste management infrastructure, hinder progress towards cleaner production and consumption processes that could reduce environmental degradation.

## Political and Institutional Processes

While the Malawi Government is committed to improved governance, environmental sustainability and inclusive growth, implementation remains hampered. Challenges include inadequate political will, limited institutional capacities and funding, poor coordination among government ministries, departments and agencies, corruption among law enforcers, all of which undermine effective policy execution.

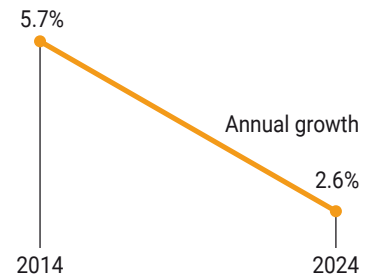
### Governance indicators



## Economy

Malawi's declining GDP has deepened the country poverty, particularly in rural areas, increasing the reliance on environmentally harmful livelihood practices, such as charcoal production, sand and artisanal mining.

### GDP decline

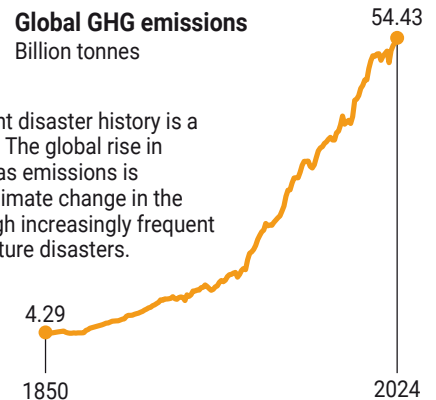


## Climate Change

### Global GHG emissions

Billion tonnes

Malawi's recent disaster history is a stark warning. The global rise in greenhouse gas emissions is manifesting climate change in the country through increasingly frequent and severe nature disasters.



## Cultural Practices

While some traditions promote environmental conservation, such as sacred graveyards and village forest reserves, others drive harmful activities for economic gain, including bushfires, tree cutting, illegal hunting, charcoal production, brick making and unsustainable farming practices.

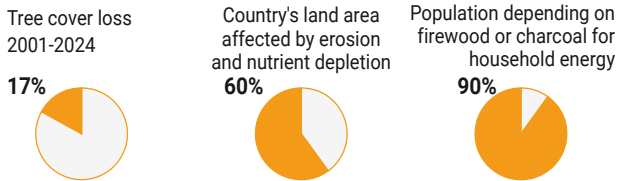


Increasing population growth, slow economic growth and climate change place higher demands and pressure on land, water and forest resources, often resulting in low food and energy provision.

# PRESSURES

## Deforestation and Land Degradation

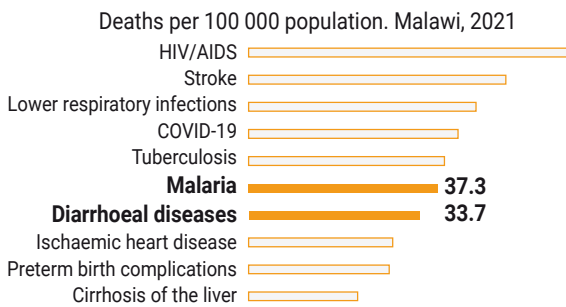
Deforestation is accelerating ecosystem decline and disrupting natural processes, leading to lack of ecosystem services in the country. Although mining, clay and sand deposits contributes to the country's GDP, the practices presents many environmental and social challenges.



## Diseases, Pandemics and Anthropogenic Disasters

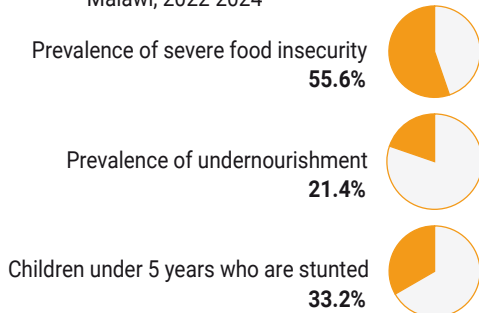
Malaria, diarrhea diseases, and malnutrition are among the main causes of death in Malawi, a situation which will further be exacerbated by climate change. Climate-induced disasters such as floods and droughts exacerbate hunger, disease and the country's socioeconomic infrastructure, while pandemics projecting to increase in occurrence pose aggravated pressure on public health.

### Top causes of death



### Malnutrition

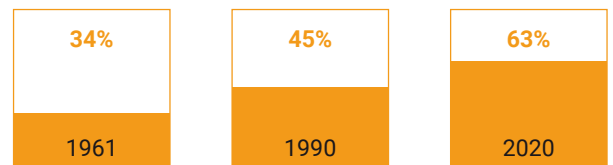
Malawi, 2022-2024



## Land use and land cover changes

Overexploitation of natural resources has caused severe land degradation and reduced soil productivity. Agricultural expansion alone has increased land use from 44.8% to 62.3%, contributing significantly to deforestation, soil erosion, ecosystem decline, and biodiversity loss. Urbanization has further intensified pressure on land resources, encroaching upon and degrading fragile ecosystems such as wetlands.

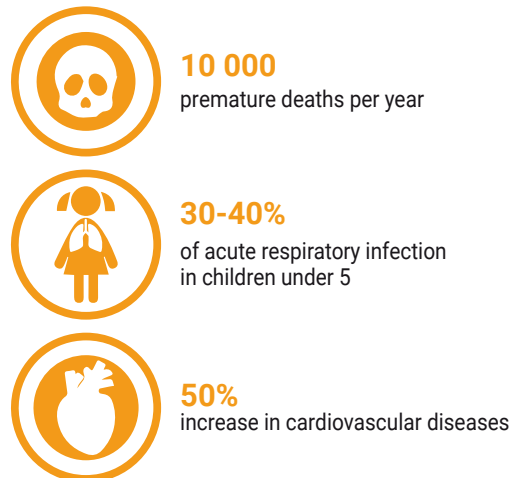
### Agricultural land



## Pollution

Pollution in Malawi has intensified due increasing reliance on biomass fuels, poor waste management, and unsustainable land use practices. Household air pollution and water contamination are major concerns, with air quality exceeding safe PM2.5 limits and surface waters polluted by runoff, mining, and industrial waste. Plastic pollution is rising rapidly, driven by single-use plastics and weak enforcement of bans—posing serious threats to soil, water, and ecosystem health.

### Impacts of air pollution on human health



Studio ATLANTIS, 2026

## 2.1 Drivers of environmental change

According to Lewison *et al.* (2016), drivers of environmental change are underlying natural and anthropogenic factors or forces that lead to pressures on the environment. The following sections presents Malawi's key drivers on the environmental change.

### 2.1.1 Demographic parameters

Population growth dynamics (gender, fertility rate, life expectancy, and migration) affect the country's ability to withstand environmental change. Dodson *et al.* (2020) underscore that demographic patterns play a crucial role in determining the magnitude of climate disruption and the ability of societies to adapt to it. As an agriculture-based economy, Malawi is more susceptible to population growth, which leads to environmental impacts such as deforestation and land degradation as people expand farmlands and settlements onto marginal lands.

The 2008 census reported Malawi's population at 13,077,160. The number jumped to 17,560,000 in 2018 with the current population for Malawi estimated at 20,734,262 (United Nations 2024; National Statistical Office (NSO) 2018). The Malawi population density is on a steady rise from 157 people per square kilometre in 2010, 181 in 2025, 207 in 2020 and 230 people per square kilometre in 2024, implying that areas that were sparsely occupied are getting more populated and the built-up area expands leading to deforestation (Figure 2.1). The

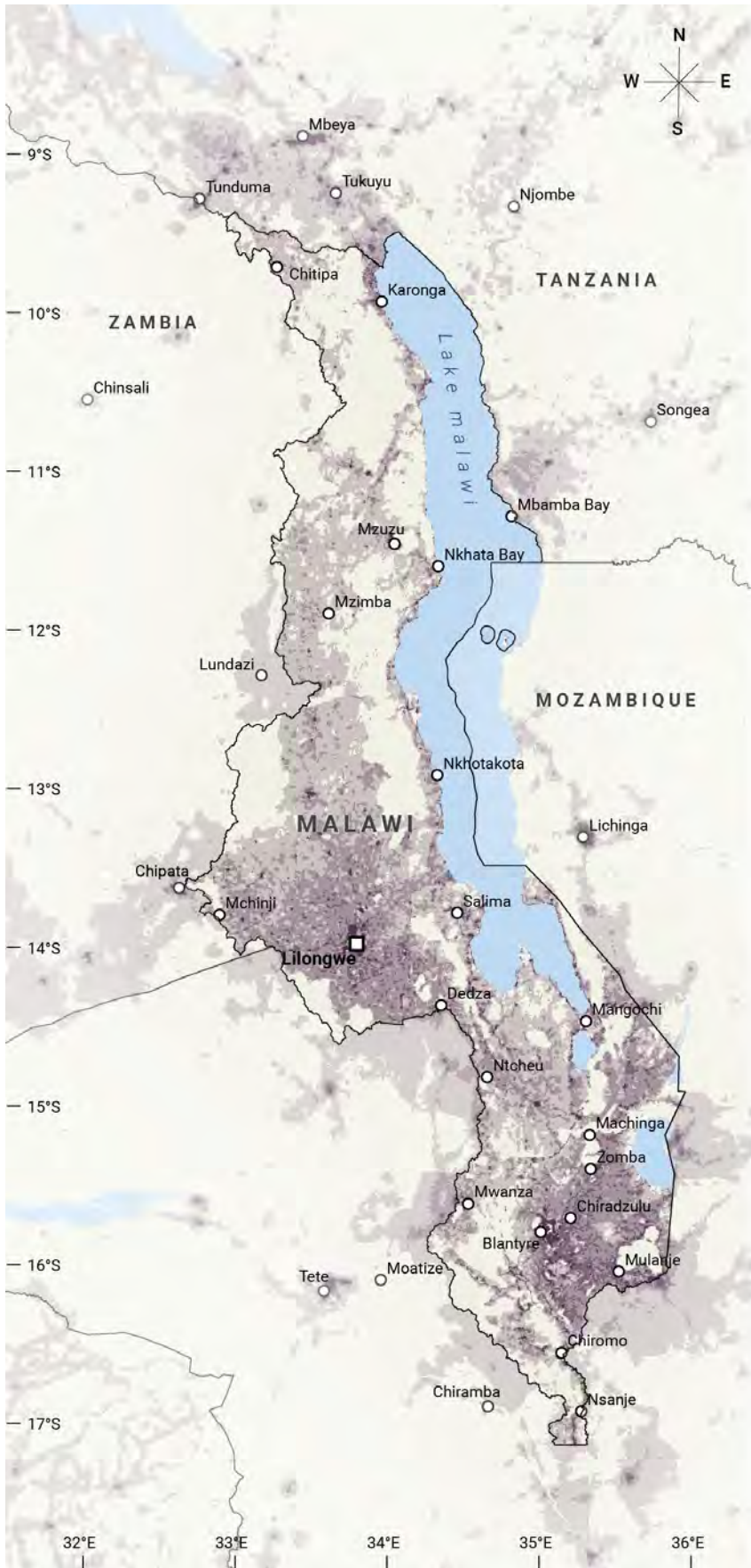
characteristics of the population like literacy, poverty, and gender also contribute to environmental change. Gender dynamics such as unequal access to resources and decision-making processes, as well as knowledge and adaptive capacity, limit mostly women's ability to adopt sustainable practices or influence policies that protect the environment.

Malawi's adult literacy level, estimated at 68.6 per cent as of 2018, falls below the global adult literacy approximately at 86.4 per cent for the same year (NSO 2018). This has a bearing on environmental matters as knowledge is key to interpreting policies and avoiding damaging human activities on the environment. Low literacy levels exacerbate poverty by limiting individual livelihood choices, leading to increased reliance on natural resources and limited access to alternative energy sources.

Rapid urbanisation, driven by high rates of rural to urban migration, also drives environmental changes in Malawi. Urban areas like Lilongwe and Blantyre have 60 to 75 per cent of residents in informal settlements, with most of the settlers relying on charcoal as an energy source for cooking (Government of Malawi 2019). As a result, the country is witnessing accelerated deforestation in peri-urban areas. Informal settlements often lack access to basic services such as safe drinking water, sanitation facilities, and waste collection, resulting in pollution on land and in water courses.

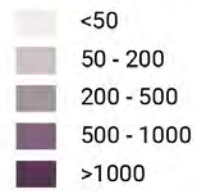


Malawi is one of the most densely populated countries in Africa. Photo: Host Vogel



## Malawi population density

### Population (persons per km<sup>2</sup>)



— Country borders

■ Lakes

○ Cities / Towns

□ Capital

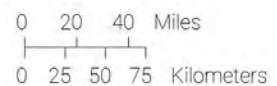
### Sources

#### Population

WorldPop ([www.worldpop.org](http://www.worldpop.org) - School of Geography and Environmental Science, University of Southampton; Department of Geography and Geosciences, University of Louisville; Departement de Geographie, Universite de Namur) and Center for International Earth Science Information Network (CIESIN), Columbia University (2018). Global High Resolution Population Denominators Project - Funded by The Bill and Melinda Gates Foundation (OPP1134076). <https://dx.doi.org/10.5258/SOTON/WP006755>

**Borders**  
UN(2025)

**Hillshade**  
ESRI, USGS



**Figure 2.1:** Malawi population density

### 2.1.2 Economy

The economy of Malawi is heavily based on agriculture, which supports about 80 per cent of the population (Government of Malawi 2024a). The country's Gross Domestic Product (GDP) has relied heavily on agriculture for decades, especially tobacco. Reduced world demand for tobacco, exacerbated by climate change and variability, has affected the agricultural sector leading to a steady decrease in the rate of growth of the nations' GDP. According to the World Bank (2024), Malawi's GDP growth rate decreased from 5.7 per cent in 2014 to 3.2 per cent in 2024, demonstrating the vulnerability of the agrarian economy to climate change and variability. Inevitably, this development has increased poverty levels mainly in rural areas where 83 per cent of the 20.7 million population reside (World Bank 2024). The heavy reliance on agriculture over the decades, especially on flue cured tobacco, contributed to significant environmental changes (e.g. deforestation hence land degradation). This consequently led to soil erosion, reducing fertility and affecting long-term productivity. Additionally, deforestation and land degradation emanating from

agricultural expansion have significantly affected water resources in Malawi.

The decline in GDP contributions from agriculture has forced the government of Malawi to diversify the economy, including through the mining sector. Mining's contribution, which is identified as a pillar for sustainable development in Malawi Agenda 2063, remains subdued to salvage the economy and create jobs; pushing people to desperate actions that put pressure on environmental resources. The mining sector contributed 10.8 per cent to the GDP in 2010, up from 0.7 per cent in 2001. Much of this contribution was through the Kayelekera Uranium Mine before it closed, leading to the contribution of the mining sector dropping to 1 per cent (Government of Malawi 2024a). The surge in artisanal and small-scale mining, especially for gold, in various parts of the country including districts of Mangochi, Balaka, Neno, Nkhotakota, Lilongwe, Zomba and Kasungu is adding more pressure on the environment. While artisanal and small-scale mining is positively contributing to the livelihood of people, it also leads to negative environmental impacts including land degradation.



Mining for sand and gold along rivers causes pollution and siltation. Photo: Host Vogel

### 2.1.3 Technology and innovation

The Government of Malawi, under the Renewable Energy Strategy (2017), has a set of priorities and actions to achieve the increased adoption and consumption of

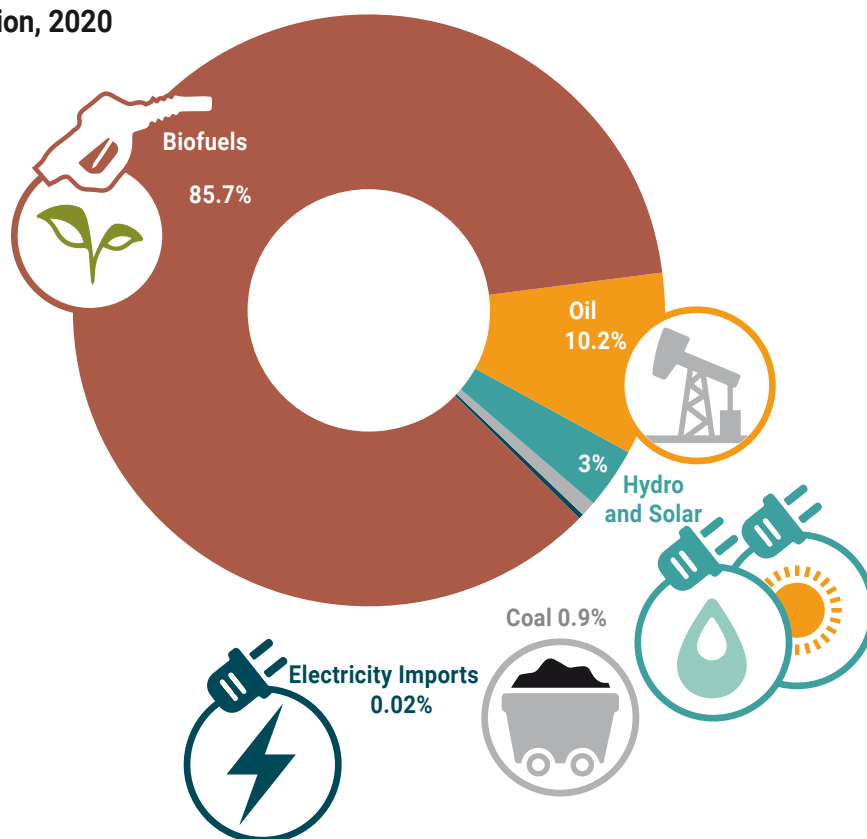
green and clean energy (Government of Malawi 2017). To transform the national energy sector, the Government of Malawi, in collaboration with various stakeholders such as the United Nations Development Programme (UNDP), has put up strategies to achieve universal access

to renewable energy through the implementation of mini-grid programmes by 2063. Since the introduction of the Renewable Energy Strategy notable progress has been made despite ongoing challenges. The country has seen the development of utility-scale solar power plants, exemplified by the completion of projects such as the 60 MW Salima, 20 MW Golomoti and 21 MW Nkhotakota projects (The Borgen Project 2024).

Private companies have also capitalised on the renewable energy strategy framework, enhancing public-private partnerships (PPPs) to expand solar home system (SHS) services to an unprecedented number of

households and communities. Despite this progress, financial, regulatory, and technical constraints have delayed key projects such as the Malawi-Mozambique Power Interconnection Project and Wind Energy Development (The Nation 2024). As of 2020, the energy production landscape is mostly focused on biofuels. The 2023 digest of Malawi’s energy statistics shows that 85.7 per cent of the household energy used is from biofuel, while a meagre 3 per cent is from hydro and solar and 0.9 per cent from coal (Figure 2.2) (Chisale and Lee 2023; Government of Malawi 2023a). This reflects a slow uptake of clean renewable energy production, and a high demand for firewood and charcoal.

### Energy production, 2020



Studio ATLANTIS, 2026

**Figure 2.2:** Share of Energy Supply in 2020. production trends (Government of Malawi 2023a)

A study by Chisale and Lee (2023) reported that the top barriers to technology and innovation uptake include lack of funding, high investment cost, and lack of spare parts. Poverty, cultural, and gender issues also have serious contributions to low uptake. Rahut (2017) found that female-headed households preferred to use clean and renewable energy sources such as electricity and solar, compared to their male-headed counterparts.

Aside from energy-related drivers, the slow uptake of technologies and innovations in agriculture and inadequate waste management technologies are also driving environmental change in Malawi. Despite the benefits of Climate Smart Agriculture technologies

like conservation agriculture and organic fertilisation, adoption is limited due to gender inequalities, lack of technical support, and unmet expectations, leading to slow or no adoption among smallholder farmers (Khoza *et al.* 2022; Nyagumbo *et al.* 2021). Malawi also faces significant challenges due to inadequate waste disposal infrastructure, including insufficient waste bins, lack of recycling machinery, and breakdowns in transportation vehicles, hindering effective waste management (Chikukula *et al.* 2024). The presence of informal waste management systems also leads to environmental risks due to the improper handling and disposal of hazardous materials (Kinally *et al.* 2023)

## 2.1.4 Governance

The Government of Malawi is committed to a transformational development agenda anchored in Malawi Agenda 2063 (MW2063) and its first 10-year Implementation Plan (MIP-1) to advance sustainable and inclusive growth, as well as to achieve most of the Sustainable Development Goals (SDGs). Since the implementation of SDGs in 2016, the Malawi government launched a number of policies and initiatives to accelerate and sustain poverty reduction and put Malawi on a climate-resilient development pathway. These include the Malawi Resilience Strategy which consists of the National Environmental Policy, National Environmental Action Plan, Environment Management Act, Climate Change Management Policy, National Forestry Policy, National Disaster Risk Management Act, National Social Support Policy. The Malawi government is also formulating the National Meteorological Policy and other key policies, strategies, and plans to create a conducive environment for sustainable environmental management and provision of social support services to the vulnerable. Despite such efforts, politics and institutional processes mostly control the direction of the implementation of the policies. Chisale and Lee (2023) documented that poor co-ordination among ministries, departments, and agencies, lack of political will, and corruption are among the barriers in as far as the implementation of environmentally friendly policies and strategies is concerned. For instance, in the implementation of renewable energy, there has been poor co-ordination between the Environmental Affairs Department of the Ministry of Natural Resources and the Ministry of Energy (Chisale and Lee 2023).

Plastic pollution is a growing concern. Malawi uses an estimated 75,000 tonnes of plastic annually, 80 per cent of which is single-use plastic. Projections indicate that plastic waste in Lilongwe alone will nearly triple from 2014 levels, reaching close to 32,000 tonnes by 2030. This waste poses a direct threat through entanglement and leaching of harmful chemicals into the soil, subsequently contaminating streams and rivers. While a plastic ban regulation was enacted in 2015, its effective enforcement has been hampered by legal and institutional challenges (Turpie *et al.* 2019; Chikukula 2024).

Similarly, in an attempt to arrest and reverse deforestation and forest degradation and to reduce energy overdependence on solid biomass fuels, the Malawi National Charcoal Strategy of 2017 put forward a ban on burning and selling charcoal from unsustainable sources. However, the implementation of the ban dismally failed due to institutional capacities. For example, when charcoal is transported on trucks, it is confiscated and the transporters are prosecuted. However, the same harsh penalty is not applied when charcoal is transported on motorbikes. This undermines the efficacy of the policy as offenders just switch the mode of transport (Government of Malawi 2017c).

## 2.1.5 Environment and climate change

Climate change is a long-term shift in weather conditions, persisting for an extended period, typically decades or longer (IPCC 2024). Malawi is vulnerable to multiple hazards whose occurrence has increased in frequency and severity. These include floods, droughts, cyclones, and landslides (Government of Malawi 2023b). The influence of El Niño and La Niña phenomena on the country's climate and tropical cyclones (for example Cyclone Ana and Cyclone Freddy in most recent times) result in highly variable rainfall patterns (World Bank 2022). Since the late 1990s, Malawi has experienced more than 19 major flood episodes and seven droughts, with these events increasing in frequency, magnitude, and scope over the years (Government of Malawi 2024c; Government of Malawi 2024d). Climate change exacerbates existing social and economic inequalities, particularly for the vulnerable population. Climate change and variability lead to crop failures, reduced harvests, and diminished food security.

## 2.1.6 Society, culture, and tradition

The environmental impact of individual behaviour is difficult to grasp, partly because issues related to climate change are perceived as psychologically distant (Sörqvist and Langeborg 2019). There are also cognitive biases specifically associated with group processes and social behaviour. People tend to favour their own needs over those of others. In view of this global and international nature of individual behaviour, the tendency to favour one's own may prevent acceptance of policies that are meant to conserve the environment.

Cultural practices, beliefs, and values contribute to environmental changes both positively and negatively. Some traditional practices promote environmental conservation, such as the protection of forests within graveyards (Phwandaphwanda and Thiruppathi 2023). There are cultural practices that contribute to the degradation of natural ecosystems such as traditional tree-cutting during funeral ceremonies practiced by the Chewas and Ngoni hunting traditions. Cultural values sometimes tolerate environmentally harmful activities for economic purposes, including lighting bushfires for hunting small animals such as rabbits, charcoal production, brick making, and poor farming practices. Conservation of natural resources is sometimes linked to people's perceptions of issues. For example, in Malawi's northern region, people practice slash and burn agriculture. This is especially prevalent in millet production. Individuals in these cultures perceive that beer and *thobwa*, a local non-alcoholic drink, made from millet grown under slash and burn conditions tastes better than an improved variety which can be planted in gardens.

Indigenous and local knowledge may help to preserve the environment through various traditional beliefs. Although indigenous and local knowledge may lack critical insights

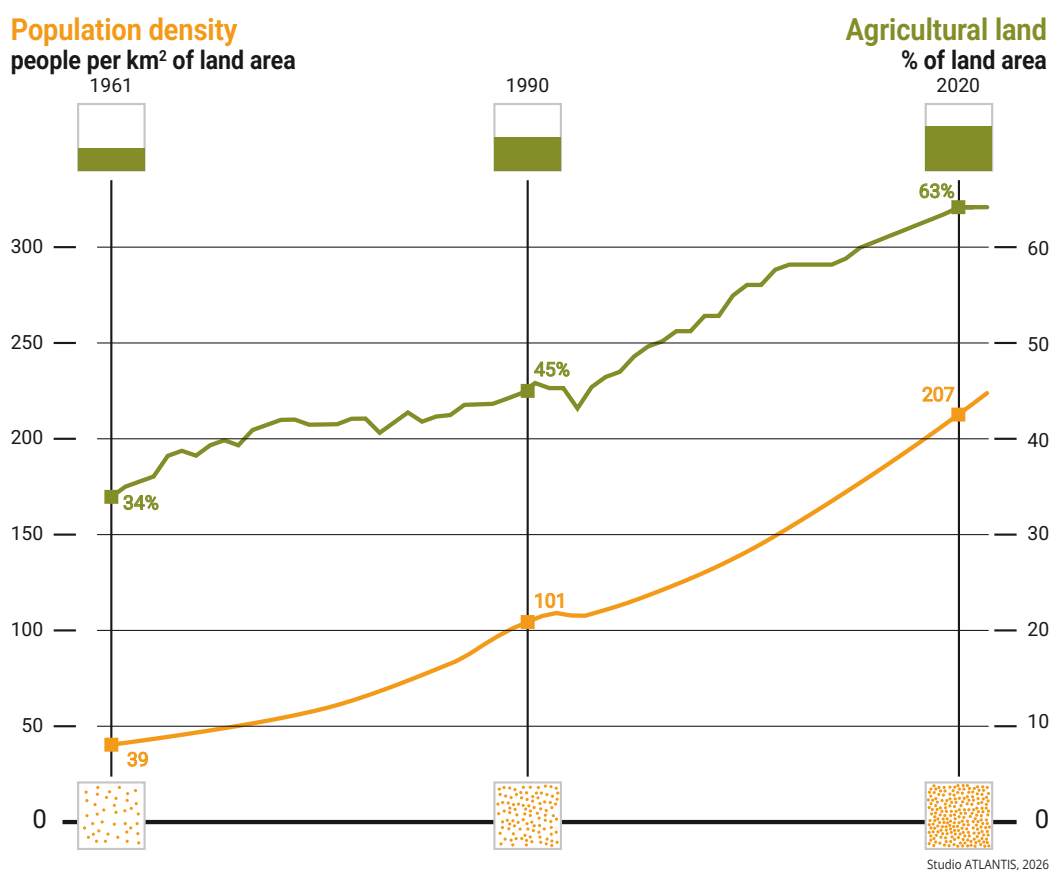
into the drivers of environmental change, it provides perspectives that complement scientific findings, and many communities in Malawi preserve forested areas based on traditional beliefs. For instance, Khulubvi Forest, a shrine situated in Nsanje district in the lower Shire Valley of Southern Malawi, has been preserved by the Mang'anja tribe for several years since it is believed that the forest is inhabited by the powerful spirit of Mbona who used to have magical powers before he died.

## 2.2 Pressures of environmental change

Malawi's environmental resources experience significant pressures, which are the direct effects or consequences of driving forces on the environment. The most significant pressures include land use and land cover change, deforestation, land degradation, and pollution.

### 2.2.1 Land use and land cover changes

Land use and land cover changes are among the pressures adding to environmental change in Malawi. About 80 per cent of the population depends on agriculture (Government of Malawi 2024), while forests provide essential resources like fuelwood and timber. As a result the country has experienced significant land use and land cover changes since the 1990s, driven by population expansion, agricultural expansion, urbanisation, and climate change. These factors have negative impacts on the environment including deforestation, land degradation, and loss of biodiversity. For instance, between 1998 and 2018 land use for agriculture increased from 44.8 to 62.29 per cent of the total land area. This expansion was proportionate to the increase in population (Figure 2.3). At current rates, Malawi's population is projected to more than double in size and reach over 40 million by 2050 (United Nations 2017) which is expected to increase the pressure on land resources.



**Figure 2.3:** The relationship between Population density and Agricultural Land Expansion (Source: United Nations 2024; World Bank 2024)

Land use and land cover changes lead to soil and land degradation in Malawi. In 2014, the national average soil loss was estimated at 29 tonnes per hectare per year. In the Northern Region of Malawi, soil loss ranged from 0.4 to 39 tonnes per hectare per year—largely influenced by topographic conditions (Vargas *et al.* 2016). Urbanisation adversely affects the physical environment in various

ways. For example, areas used for brick moulding are heavily degraded leaving pits that are sometimes used as waste dumping sites. Brick burning to harden bricks, contributes to deforestation leading to biodiversity loss, soil erosion, and soil infertility (Government of Malawi 2010).

## 2.2.2 Deforestation and land degradation

Deforestation and land degradation are among the most pressing environmental issues in Malawi, largely driven by population growth, resource exploitation, and expanding agricultural land needs. As a consequence of natural resources degradation, water catchments, soil fertility, and the stability of ecosystems are greatly impacted, which further presents serious challenges to sustainable land and water resources management.

Indigenous and local knowledge (ILK) offers valuable insights, beliefs, and practices that can help mitigate the effects of deforestation and degradation. For instance, Indigenous peoples and Local Communities in Malawi engage in agroforestry practices, where trees are integrated with crops to preserve fertility and maintain biodiversity. Indigenous and local knowledge also encourages sustainable harvesting of forest resources and the cultural importance of preserving sacred graves, which act as natural conservation sites. Historically local communities used indigenous and local knowledge techniques for water management, such as contour farming and the construction of water retention structures, to reduce soil erosion and promote resilience of water catchments.

### 2.2.2.1 Population dynamics and deforestation

Deforestation is estimated to be responsible for the loss of 33,000 ha of forests per year. As reported by the Global Forest Watch (2023), between 2001 and 2023, Malawi lost 247,000 ha of tree cover. During this period, the southern and northern regions were responsible for 51 per cent of all tree cover loss, with Nkhata Bay having the most tree cover loss at 92,600 ha compared to an average of 8.82 ha. Charcoal and firewood dominate Malawi's energy mix. About 96 per cent of Malawians use biomass energy like firewood or charcoal to meet their basic household energy needs. Charcoal is largely an urban fuel, used by 11.3 per cent of all households nationally and 54 per cent of urban households in 2015 (Government of Malawi 2017c).

In general, exploitation of forest products disrupts natural processes such as biogeochemical, hydrological, and ecological cycles, leading to a decline in ecosystem services (Munthali *et al.* 2020; Ngwira and Watanabe 2019; Lemaire and Dowsett 1988).

### 2.2.2.2 Mineral and sand exploitation on environment

Exploitation of minerals, sand, and clay has significant economic potential, as evidenced by the then 10.8 per cent contribution of mining to GDP in 2010. This is despite mining presenting many environmental challenges which emanate from the processes of exploration, development, and extraction. Any mining activity, whether artisanal and small-scale or large-

scale, disturbs the surface of the earth which creates a visual impact for its duration. Such visual impacts on the environment can be seen in many sites in Chitipa, Karonga, Kasungu, Mangochi, Balaka, Nkhhotakota, Lilongwe, and Zomba. Environmental impacts not associated with visual aesthetics include pollution of ground and surface water.

Open cast mining in regions like the Livingstonia coalfield and Thundulu Phosphate Mine has raised concerns about water pollution. As reported by Wanda *et al.* (2021), mining activities in the Livingstonia coalfield have led to hydrogeochemical processes such as carbonate weathering, evaporation, precipitation, and acid mine drainage, which influence water quality.

Increased illegal mining activities, especially gold panning, are conducted along riverbanks or within the river. Pollutants are also introduced into surface water bodies through mineral cleaning processes.

Apart from mineral resources, there are a variety of clay and sand deposits; including brick clay, ceramic clay, and silica sand; that are mined for construction and industrial use. Despite the economic benefits of sand and clay mining, significant environmental and social challenges are incurred. Pullanikkatil *et al.* (2016) noted that sand mining activities in Malawi are mostly conducted illegally, causing increased soil erosion. This is mainly due to the gullies formed by the removal of sand, which destabilises the soil structure and makes it more susceptible to erosion. The process of sand mining often leads to increased clearing of vegetation. Similarly, clay mining involves the clearing of overlying burdens which include vegetation. This not only reduces the biodiversity of the area but also disrupts local ecosystems. The removal of native plants leads to the spread of alien vegetation, which further alters the habitat and makes it less suitable for native species.

The other environmental impacts of both sand and clay mining in Malawi include the collapse of riverbanks and water pollution. Ngochera (2014) noted that the illegal mining of sand increased siltation and pollution of significant water bodies in Malawi. Sand and clay mining taking place on riverbanks or within the rivers pose a threat to freshwater and fish biodiversity. Due to the eroded or collapsed riverbanks, these mining activities also have the potential to increase flooding cases along these sites. Riverbed mining often removes sand that acts as a buffer to absorb excess water. With reduced natural capacity for water storage, the risk of flooding increases during heavy rains, consequently damaging local communities and infrastructure.

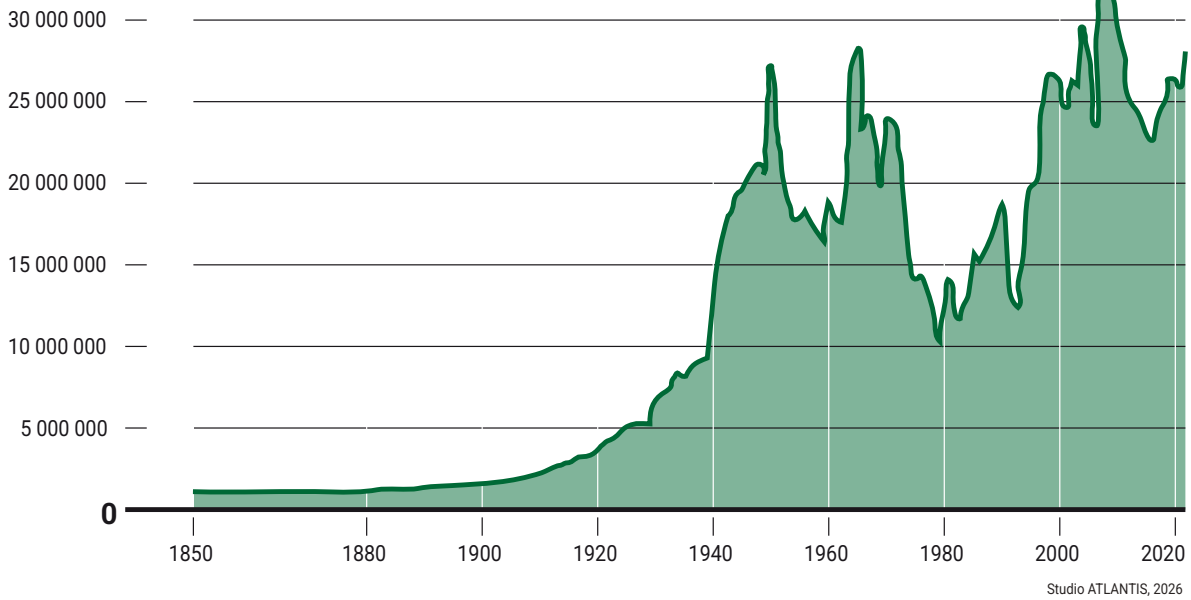
## 2.2.3 Pollution

By global standards, Malawi has very low greenhouse gas emissions. In 2019, the country's total greenhouse

gas emissions were only 19.34 million tonnes (metric tons) of carbon dioxide equivalent (MtCO<sub>2</sub>e), including emissions from land use change and forestry. The average greenhouse gas emissions of 0.59 MtCO<sub>2</sub>e per capita is one of the lowest in the world (World Bank 2019).

Malawi's main greenhouse gas contributing sectors are agriculture and forestry, energy, and industrial processes. The country's total annual greenhouse gas emissions are expected to rise by around 38 per cent between 2015 and 2040 (Figure 2.4) (World Bank 2019).

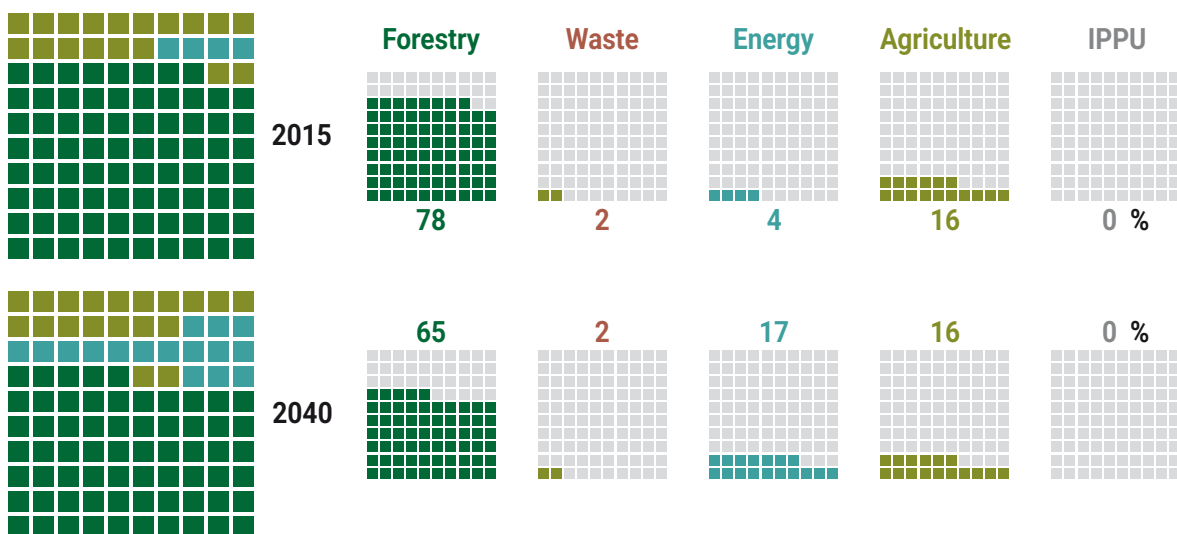
### Greenhouse gas emissions Metric tonnes of CO<sub>2</sub> equivalent



**Figure 2.4:** Trend in Malawi's greenhouse gas emissions by population (World Bank 2019)

As shown in Figure 2.5., the forestry sector contributes significantly to Malawi's air pollution because of an increased reliance on fuelwood and charcoal for energy.

### Sectoral Emissions



Studio ATLANTIS, 2026

**Figure 2.5:** Sectoral emissions by 2015 and 2040 (Government of Malawi 2021).

Given that 96 per cent of Malawi's population use biomass fuels for energy, the level of household air pollution is extremely high. Household air pollution is the world's number one environmental cause of death and affects two-thirds of the world's population. According to the World Health Organization (2021), the air quality in Malawi is considered moderately unsafe with the annual mean concentration of 24 µg/m<sup>3</sup> of PM<sub>2.5</sub>, which exceeds the recommended maximum of 10 µg/m<sup>3</sup>. Deforestation, which is high in Malawi, will increase the rate of air pollution.

Environmental changes have also contributed to the contamination of water resources in Malawi. Many surface water sources are polluted because of deforestation, unsustainable agriculture, settlements, mining, industry, commerce, and anthropogenic disasters (Government of Malawi 2010). Soil erosion caused by deforestation increases sediment loads into the rivers, altering the

directions or restricting the flow of the rivers and causing flooding and exacerbating water pollution. Agricultural chemicals, such as inorganic fertilisers, herbicides, and pesticides have also increased nutrient levels in the rivers and lakes, causing the proliferation of algal blooms and pollution of water bodies. Flooding spreads waste from poorly managed dumpsites and contaminates local water sources.

Soil erosion and land degradation are widespread and severe. According to Vargus and Omuto (2016), the average annual national soil loss rates in 2014 were estimated at 29 tonnes per hectare. In addition, soil erosion and nutrient depletion are reported to affect more than 60 per cent of Malawi's land area (Davies *et al.* 2010). The key drivers of degradation are unsustainable farming practices and increasing demand for agricultural land and wood fuels, which are associated with a growing population.



Charcoal production is one of the major reasons for deforestation. Photo: Emily Phiri

Waste generation and disposal are increasing in Malawi. Effluent and solid waste from companies is dumped into water bodies due to insufficient waste disposal mechanisms, hence polluting the environment. Rapid urbanisation, coupled with changing consumer demands, is driving further escalation in plastic production in Malawi. Based on population growth rates, it is estimated that by 2030 the amount of plastic waste generated in the capital city, Lilongwe, will be close to 32,000 tonnes.

This is more than double the plastic waste produced in 2014. The waste problem has not spared tourist attraction areas. For example, in Mulanje Mountain, the dumping of plastic bags and bottles also attracts pests such as rats, making the area extremely unhygienic and a health hazard. Additionally, the variable rain causes the plastics to leach chemicals into the soil, which further infiltrates and contaminates the streams and rivers (Turpie *et al.* 2019).

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Photo: Horst Vogel



# 03 Land and soil

**Coordinating Lead Authors:** Ivy Sichinga Ligowe, Frank Mnthambala

**Lead Authors:** Chandiona Munthali, Kefasi Kamoyo

**Fellow:** Happy Mphande

## Executive summary

**The average size of landholdings in Malawi has been declining steadily, primarily due to increasing population** (*well established*). Between 2010 and 2016, farm sizes shrank by over 6 per cent, from an average of 0.78 to 0.73 hectares. This trend continued from 2016 to 2024, with farm sizes decreasing by a further seven per cent. The shrinking of landholdings is a direct consequence of population growth and the increasing demand for land for both agricultural and residential purposes {3.1.2, 3.2.1}.

**Land degradation, particularly soil erosion, poses a significant challenge to Malawi's agricultural productivity** (*well established*). Approximately 8 million hectares of land are affected by some form of degradation. Soil erosion, driven by over-cultivation, deforestation, and poor agricultural practices, is especially severe in Nkhata Bay District, where erosion of topsoil, which is crucial for maintaining soil fertility and supporting crop production, can reach as high as 38.28 tonnes per hectare per year.

**Maize is the dominant crop in Malawi, occupying the largest proportion of the country's agricultural land** (*well established*). Despite the large area dedicated to maize cultivation, yields remain relatively low, typically below 2,500 kg per hectare. This low productivity is attributed to several factors, including poor soil fertility, inadequate irrigation, limited access to modern farming technologies, and climate change. As a result, the increase in maize production is a reflection of expanding land under cultivation rather than an improvement in yield efficiency. This expansion in land under agriculture has come at a cost to forests, which have decreased from 28 to 22 per cent of the country's total land area. The deforestation associated with agricultural expansion leads to soil erosion, loss of biodiversity, and disruption of ecosystems, raising concerns about the long-term sustainability of both agriculture and environmental health.

**Soil health in Malawi is generally poor, with low levels of organic matter content, essential nutrients, and degraded soil structure. Indicators of soil health, such as acidity and nutrient content, are often below optimal levels, leading to poor crop yields** (*established but incomplete*). The country loses significant amounts of nitrogen, phosphorus, and potassium each year due to soil erosion and nutrient depletion. This decline in soil health has a direct impact on national agricultural productivity and, by extension, the economy. In response to nutrient depletion, the use of inorganic fertilisers in Malawi has risen significantly. Between 2013 and 2021, fertiliser use increased by 52.3 per cent, with application rates growing from 33 kg per hectare to 96 kg per hectare. The increased use of inorganic fertilisers does not address physical and biological aspects of soil health.

**Malawi's economy is agro-based, making land a key asset for the country** (*well established*). Covering a total

area of 118,480 square kilometres of which 20 per cent is covered by surface water, land is largely used for agriculture, settlements, mining, and tourism. Agriculture alone employs 85 per cent of the country's workforce comprising mostly of smallholder subsistence farmers. Agriculture also significantly contributes to the national and household food security and nutrition.

**As of 2010, about 74,900 square kilometres of Malawi's land was reported to be agricultural land, supporting a population of approximately 14 million people. Over the past two decades, both human and livestock population have steadily been increasing, with the human population reaching 20.7 million in 2024.** The increasing population trends put immense pressure on land and soil, contributing to changes in forest cover, expansion of agricultural land, and intensified farming systems. Increasing human and livestock pressure on land leads to land and soil degradation, while also worsening the impacts of floods and droughts, among other climate related shocks.

**Integrating Indigenous and Local Knowledge (ILK) with modern science offers a proven pathway to enhance agricultural resilience to climate shocks.** (*established but incomplete*). The backbone of the agricultural sector in Malawi is formed by smallholder farmers, who often rely on traditional knowledge to determine the management of land use, crop rotation, and soil fertility. Some practices such as intercropping, agroforestry, and use of organic compost are derived from local resources rooted in ILK and have been proven to be effective in preserving soil health and mitigating degradation. Indigenous Peoples and Local Communities living near riverbanks and wetlands own traditional ecological knowledge about soil-water interactions, informing practices that reduce soil erosion and maintain fertility. Some examples of ILK-based interventions include the use of vetiver grass for erosion control and the planting of indigenous tree species to stabilise riverbanks. In addition, cultural norms often guide the conservation of sacred groves and graveyards, which serve as reservoirs of biodiversity and prevent land over-exploitation.

**Integrating Indigenous and Local Knowledge with modern scientific approaches can enhance the resilience of agricultural systems to climate shocks** (*established but incomplete*). Traditional rainwater harvesting methods, integrated with contemporary irrigation technologies, can mitigate the effects of prolonged dry spells. Inclusive collaborative research with scientists and local communities can further refine conservation techniques ensuring they remain adaptive to changing environmental conditions. Incorporating ILK into systematic analyses of land and soil trends in Malawi is essential for sustainable management. This integration supports food and nutrition security as well as enhancing the resilience of natural ecosystems, ensuring they can withstand future environmental and climate challenges.

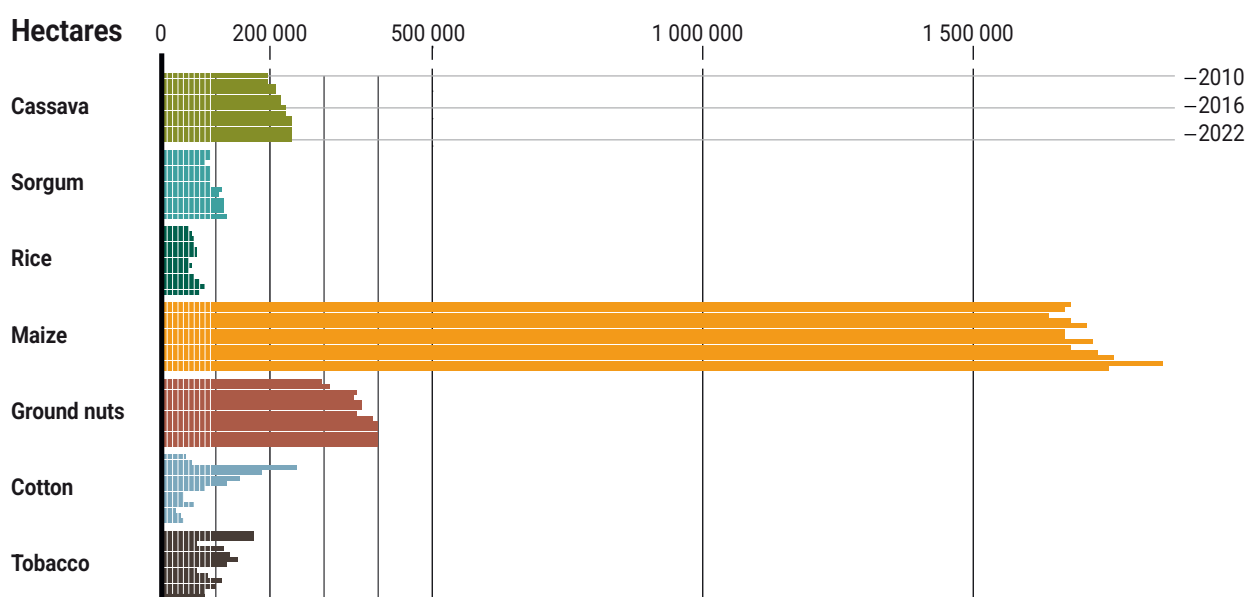
### 3.1 Overview of Malawi's agricultural sector

Malawi's agriculture is dominated by smallholder farmers cultivating less than one hectare of land. In contrast, a limited number of estates of over 25 hectares each grow export crops such as tobacco, tea, sugar, and macadamia. Almost 90 per cent of farming is rain-fed with limited irrigation infrastructure (World Bank 2018).

The main food crops include maize, cassava, sorghum, rice, and groundnuts; while cash crops include tobacco, tea, coffee, cotton and wheat (Gourichon *et al.* 2017; Lencucha *et al.* 2020).

Figure 3.1 shows the average land area allocated to selected cash and food crops in Malawi. It shows that maize dominates land use, with an average land area of 1,712,944.8 hectares. Ground nuts and cassava are distant seconds, grown mainly for food on 371,533.8 hectares and 225,762.8 hectares, respectively (FAO) 2024).

#### Crop land areas



Studio ATLANTIS, 2025

**Figure 3.1:** Land sizes for different crops from 2010 to 2022 (Data source: FAO 2024)

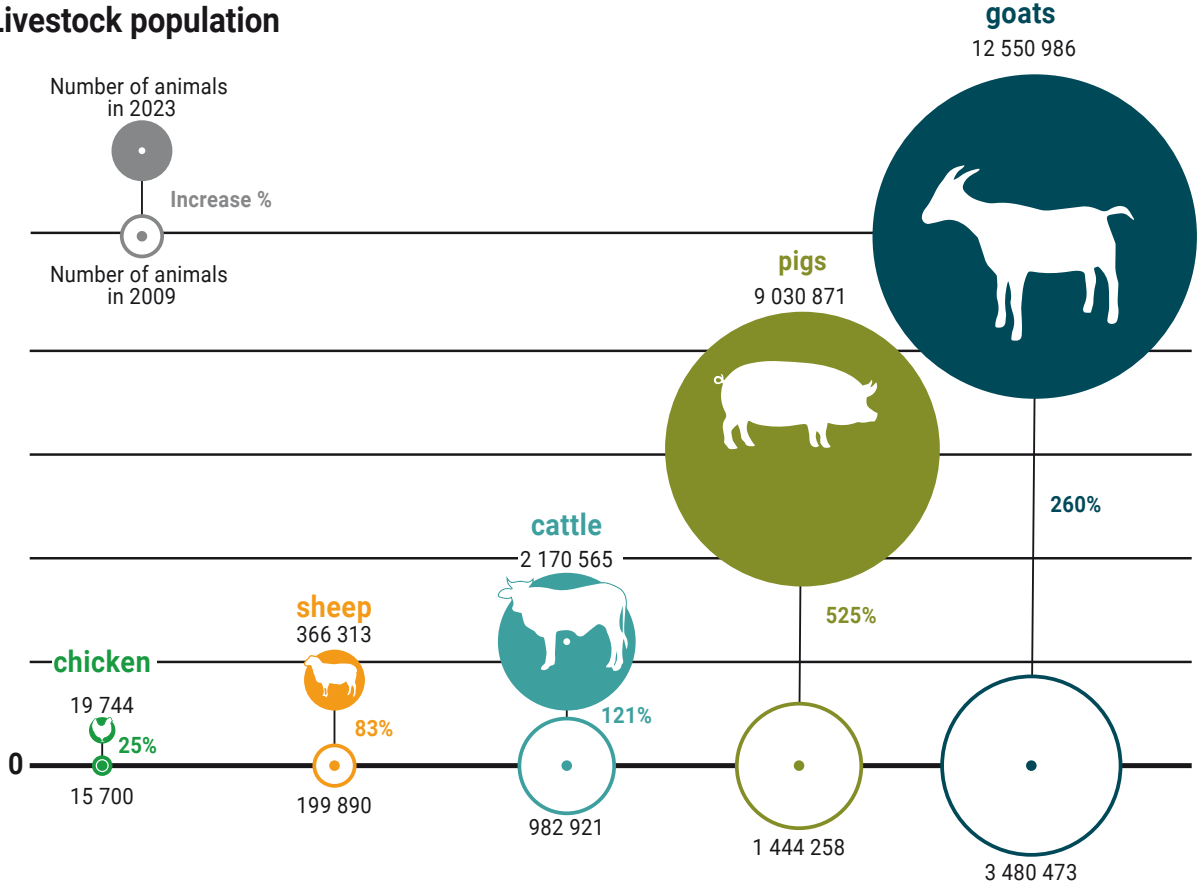
The livestock sector in Malawi accounts for 36 per cent of the agricultural GDP. At the household level, the sector contributes an estimated 16 and 50 per cent of total annual income (FAO 2022).

Livestock farming occupies about 1.85 million hectares of permanent pasture. The sector is dominated by small-scale rural based producers who own 70 per cent of the total livestock population. The most common types of livestock raised in Malawi are cattle, goats, pigs, sheep and poultry. Indigenous breeds are dominant,

accounting for over 80 per cent of national herd (FAO, 2022). Goats are the most widely kept, especially among female-headed households, while cattle are concentrated in wealthier households and used for milk and draught power (Sova *et al.* 2018; Kaumbata *et al.* 2020; Kalimbira *et al.* 2021).

The patterns of production within the nation reveal a remarkable surge in the population of livestock. Figure 3.2 shows changes in the populations of the five main livestock types in Malawi.

# Livestock population



Studio ATLANTIS, 2025

Figure 3.2: Livestock population trend from 2010 to 2023 (Data source: FAO 2024)

## 3.2 Land use and land cover change

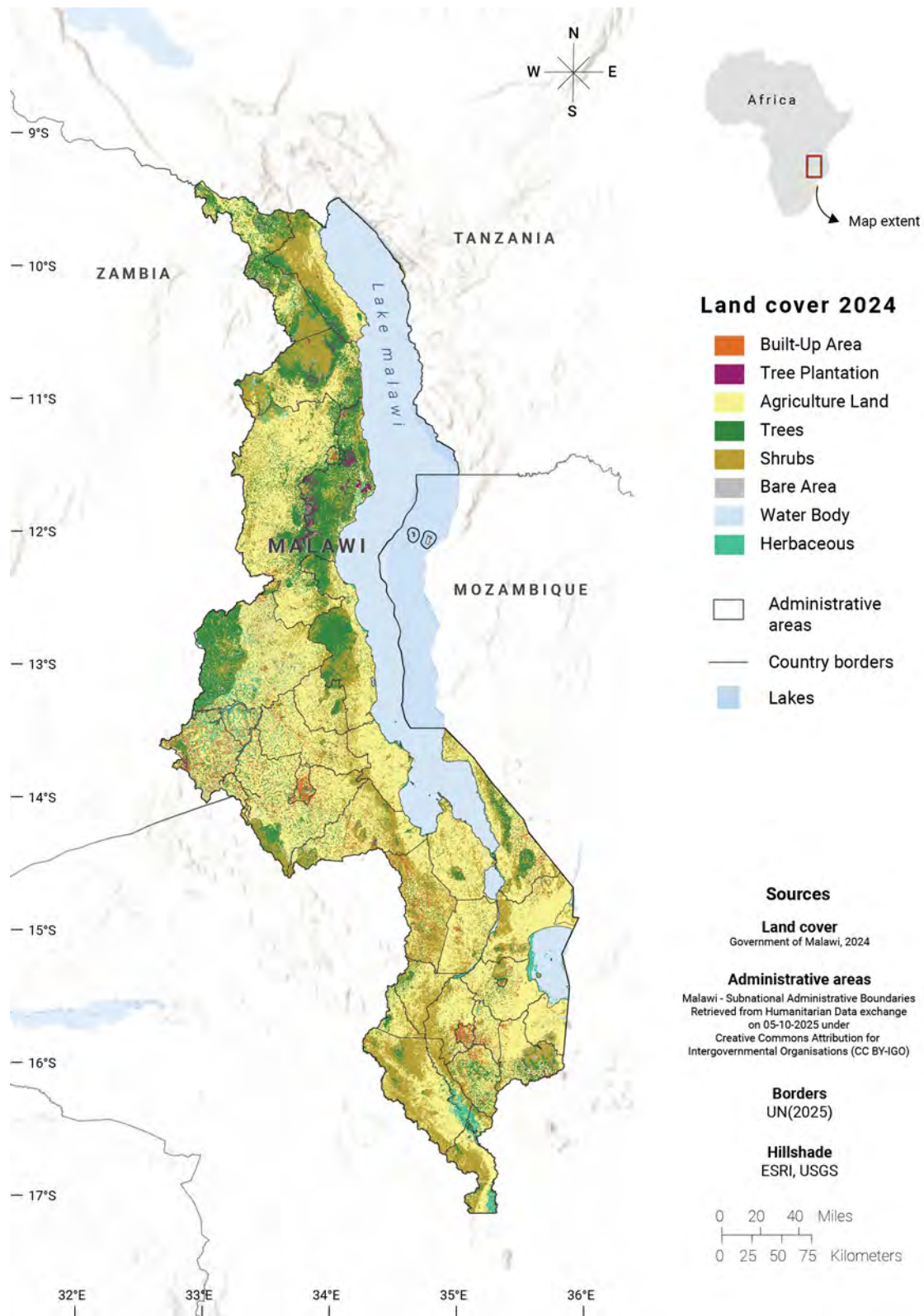
Malawi’s land cover is dominated by agricultural land, shrublands, forests, and water bodies, highlighting the importance of natural resources in human livelihoods. The 2024 national land cover assessment shows that agriculture occupies about 47,400 square kilometres (40 per cent) of the country’s total land of 118,480 square kilometres. This confirms a continued expansion of farmland since 1991, mainly driven by population growth and the need for food and income (FAO 2024).

Shrubland accounts for 20,900 square kilometres, while natural forests account for 16,300 square kilometres. Forest plantations, mainly pine and eucalyptus, cover an additional 680 square kilometres. Despite the ecological value of forests like providing timber, energy, carbon storage, and watershed protection, deforestation remains a pressing challenge. Recent national estimates place Malawi’s deforestation rate at approximately 2.8 per cent per year (Government of Malawi 2016).

Deforestation is estimated at 33,000 hectares per year, driven mainly by agricultural expansion, tobacco curing, and heavy reliance on biomass for energy (Ngwira and Watanabe 2019).

Built-up areas have increased to 4,360 square kilometres, reflecting urban growth in major cities such as Lilongwe and Blantyre. Water bodies, mainly Lake Malawi and associated wetlands, cover about 24,300 square kilometres, sustaining fisheries and tourism.

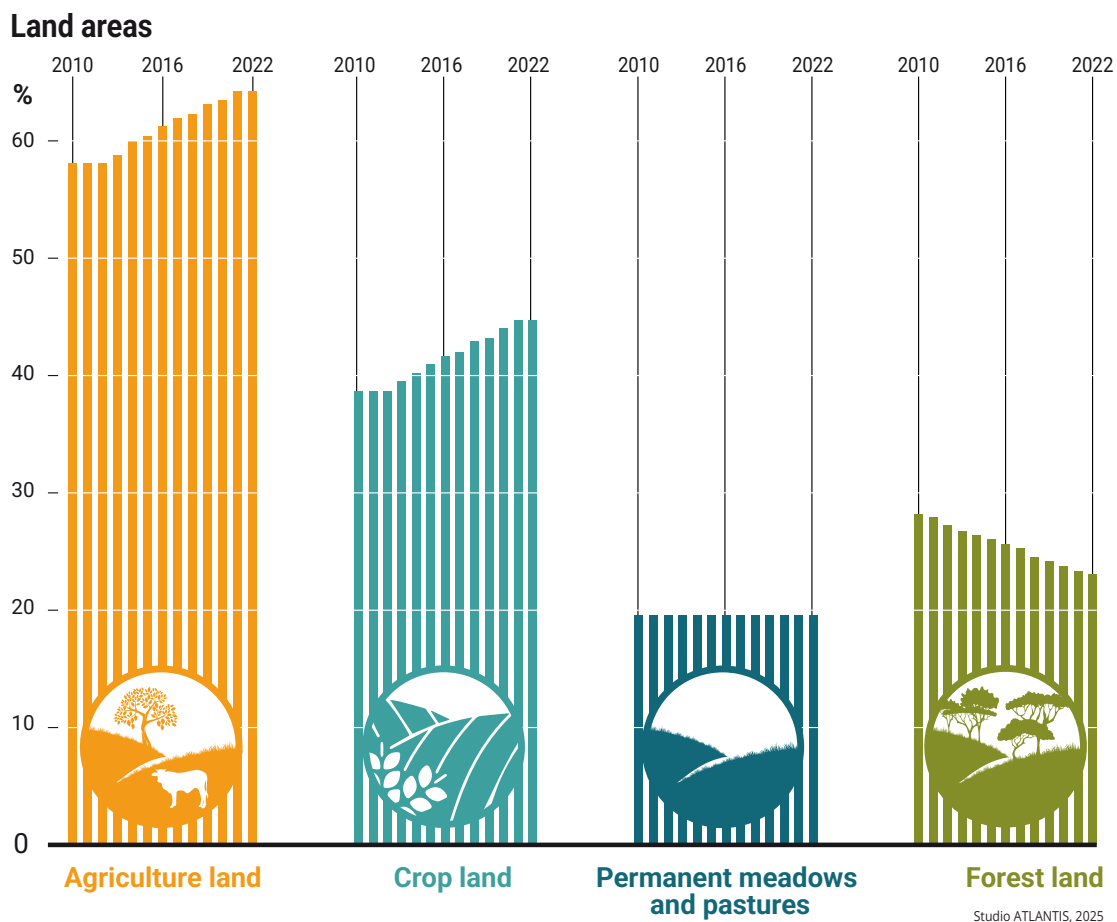
Herbaceous vegetation, covering three per cent of the country’s land area, and bare land, covering one per cent, often represent degraded or transitional ecosystems. The ongoing conversion of forest and marginal lands into agriculture continues to degrade soils, especially on erosion-prone soil groups such as Lixisols and Cambisols, which dominate large portions of Malawi’s land area (Dijkshoorn et al. 2016). Figure 3.3 below shows the land cover map for Malawi.



**Figure 3.3:** Main land use/cover types in Malawi 2025 (Government of Malawi 2025)

As Figure 3.4 shows, the increase in agricultural land and the decrease in forest land suggest that the forests are converted to agricultural land use. At the same time, permanent meadows and pastures have largely remained unchanged, indicating a densification of livestock-related

activities. In some instances, the decrease in forest cover may not necessarily mean that the forest land is being converted to agricultural land. Some patches of land are simply left bare after trees are cut down for firewood and charcoal (FAO 2024).



**Figure 3.4:** Trend in land use zonation in Malawi regarding agriculture (FAO 2024)

### 3.3 Land holding sizes, access, and tenure arrangements

Land holding sizes have been decreasing due to the increase in population. Farm sizes declined by more than six per cent between 2010 and 2016, from an average of 0.78 to 0.73 hectares. This trend continued between 2016 and 2024, with farm sizes declining by around seven per cent from 0.73 to 0.66 hectares. (Muyanga 2020).

With a growing population, access to land and associated resources such as water are often contested due to decreasing land holding sizes.

In Malawi, land is divided into three major tenure systems: public, private, and customary. Prior to 2016 reforms, more than 90 per cent of the land was under customary tenure, managed through lineage systems without formal legal recognition. The 2016 Land Act and National Land Policy of 2002 formalised landholding under public and private categories, allowing for greater land security and investment opportunities (Chikaya-Banda and Chilonga 2021).

Customary tenure remains dominant, covering over 6 million hectares, while private and public land accounts for 1.2 million and 1.8 million hectares, respectively. Inheritance patterns and land fragmentation, especially

in matrilineal societies, continue to constrain productivity due to ill-defined land rights. Insecure tenure also limits access to agricultural finance, reducing investment in livestock and crop management (Chikaya-Banda and Chilonga 2021).

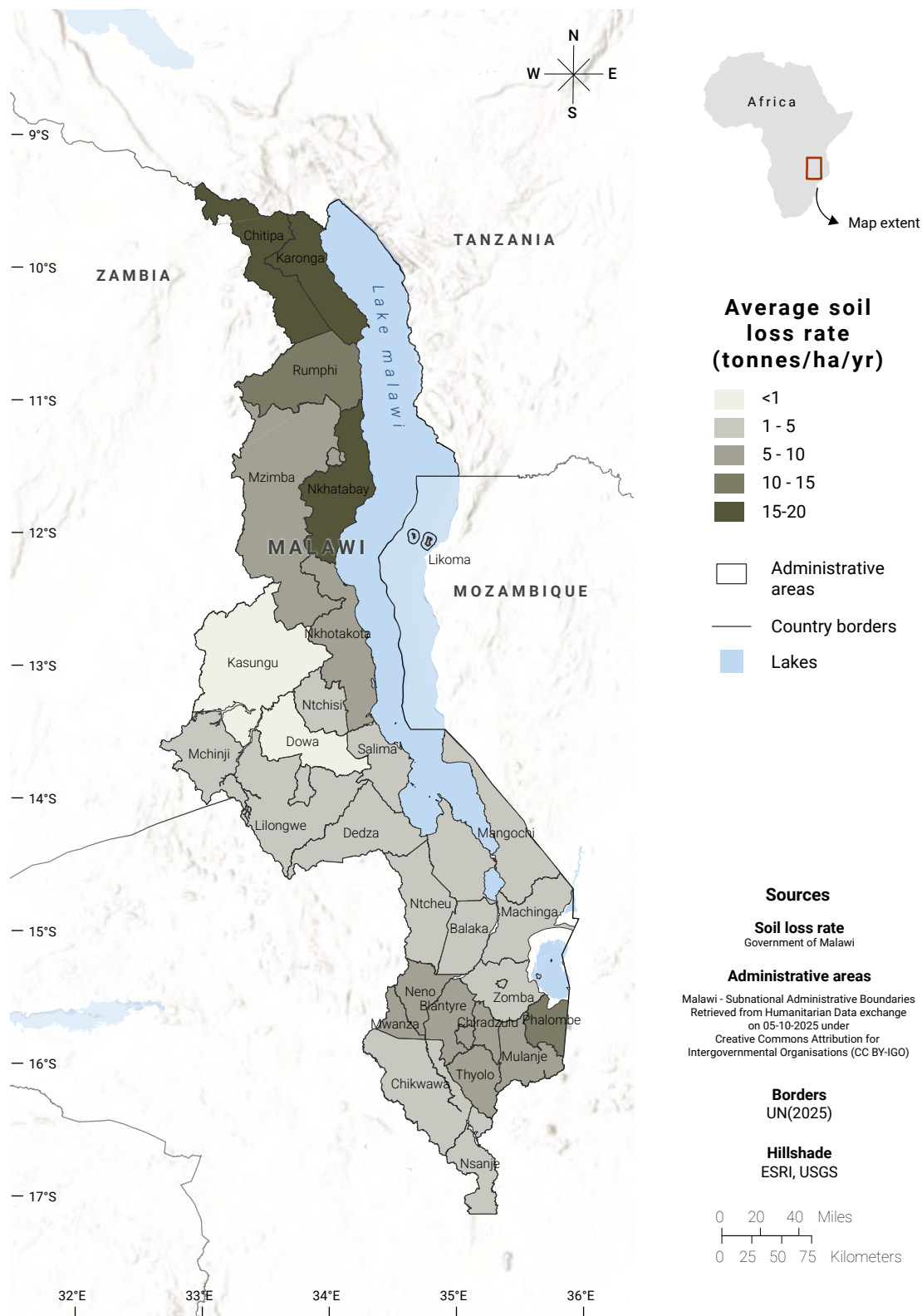
### 3.4 Land degradation

Malawi's land resources continue to face pressure due to an expanding population, accelerated by anthropogenic activities which are causing soil erosion, deforestation, water resources degradation and depletion, and climate change. The 2018 population census shows that Malawi's population is nearly four times that of 1966 and 1.3 times that of 2008. The population, which was estimated at 20.7 million in 2024, is expected to double by 2042 (Government of Malawi 2019). This high growth rate, combined with a low rate of literacy, contributes to high levels of poverty leading to over-reliance on land resources for livelihood.

Land degradation is affecting livelihoods of many Malawians. It is estimated that over 80,000 square kilometres of land is degraded in the country. Estimated topsoil erosion losses range from 0.11 tonnes per hectare per year in Mangochi district to 39.74 tonnes per hectare per year in Karonga district, with a total national average of 29 tonnes per hectare. Figure 3.5 shows

the average soil loss rates for the country. Nkhata Bay records one of the highest mean soil erosion rates at 19.83 tonnes per hectare per year, with minimum rates of 2.28 tonnes per hectare per year. The Nkhata Bay District has steep slopes, fragile soil, and high rainfall, all of which could contribute to its high erosion rates (Vargas *et al.* 2016).

Land degradation limits access to vital ecosystem services, such as food production and water supply, and increases the risk of poverty. Investments in better land management can bring more agricultural returns. The aforementioned information describes the magnitude of land degradation to the overall economy of the country, which contributes about 7 per cent of GDP loss (Global Mechanism of the UNCCD 2018).



**Figure 3.5:** The soil loss rate across the country (Vargas *et al.* 2016).

### 3.4.1 Mining and land degradation

Mining is one of the major causes of land degradation in Malawi. The country is endowed with a variety of mineral resources which include gold, uranium, coal, rare earth minerals, bauxite, limestone, and gemstones.

In 2010, mining contributed 10.8 per cent of GDP, while its current contribution is estimated at 0.7 per cent (Government of Malawi 2024). Although minerals contribute to economic gains, they also put pressure on the environment. The environmental pressure is more pronounced due to the surge in artisanal and small-scale mining, which is unregulated and does not abide by any environmental protection regulations, leading to negative effects on the environment including land degradation.

Although limited studies have been conducted in Malawi to assess the environmental impacts of mineral resource exploration, existing evidence indicates that exploration activities can lead to soil erosion and loss through excavations, the loss of agricultural land, forests and woodlands, and the pollution of surface and groundwater resources. In large scale mining activities, the exploratory stage of mineral resources degrades the soil through vehicle traffic, drilling and materials storage, which affects the soil structure mainly through compaction, and soil chemistry as a result of petrochemical spills. Malawi's mining sector is dominated by artisanal and small-scale mining, which is carried out through labour-intensive methods that leave scars on the landscape and pollute rivers (Chimwala 2018).

In the developmental phase of mineral resource exploitation in Malawi, potential environmental impacts arise from activities such as site clearance, construction, and waste handling. The extraction phase of mining in Malawi results in a variety of environmental and social impacts. While the most visible is landscape alteration, underground and surface water resources are also affected. Natural hydrogeochemical processes such as evaporation, precipitation, and carbonate weathering occur independently of mining activities. Findings from Livingstonia coalfields highlight the localised nature of these impacts. Although surface water near coal

mining sites shows moderate to neutral pH and limited contamination, underground work presents a higher risk of acid mine drainage formation due to oxidation of sulfide-bearing rocks (Makwinja *et al.* 2004). Many gold mining activities in Malawi take place along riverbanks or within river channels. Pollutants are also introduced into surface water bodies through mineral cleaning processes.

### 3.4.2 Deforestation and land degradation

From 1972 to 2009, Malawi was experiencing an annual net loss of 5 per cent of its forests (Bone *et al.* 2016). The net forest loss is said to have increased to 16 per cent per year between 2000 and 2023, representing a loss of 247,000 hectares of forest cover and an additional 105 metric tonnes of carbon dioxide emissions during this period (Global Forest Watch 2023). These losses in forests are being driven by poor land and soil management practices in the face of increasing human population which puts an immense pressure on natural resources, especially for energy sources through firewood and charcoal (Shah *et al.* 2023).

Gondwe *et al.* (2019) observed that land allocated to agricultural activities increased by about 9.6 per cent between 2009 and 2018. This suggests that, as the demand for food and other agricultural products grow, forest cover will continue to decline unless improved land and soil management approaches are used to increase productivity per unit area rather than increasing land area for cultivation.

## 3.5 Soil health and agricultural productivity

Soil health reflects the soil's ability to sustain plants, animals and humans (Bünemann *et al.* 2018). Key indicators of soil health, as shown in Table 3.1, include chemical, physical, and biological properties (Tahat *et al.* 2020). Studies reveal that Malawi's soils are generally acidic with a pH of less than 5.5, with low organic matter of less than 2 per cent, and moderate nitrogen of less than 0.2 per cent (Njoloma *et al.* 2016). These deficiencies in nutrient availability result in low crop yields.



Low crop yields are due to several factors, including poor soil fertility. Photo: Nina Lande

**Table 3.1:** Soil health indicators (Source: Stevens 2018)

Chemical	Physical	Biological
N, P, K, pH, OM S, Zn, Ca, Mg, Na CEC	Bulk density Aggregate stability Water infiltration Available water content	PLFA*, enzyme activity Soil respiration Soil protein Soil pathogens Bio-available N and P Active carbon

\*Phospholipid fatty acid analysis

Soil fertility across Malawi’s agricultural areas shows widespread deficiencies in organic carbon, zinc, calcium, and potassium (Malunga 2022) as shown

in Table 3.2. As such, targeted lime and organic matter applications are necessary to improve soil pH and structure.



Red soils are widely used for maize and tobacco farming, giving fair yields but prone to acidity and loss of fertility. Photo: Horst Vogel

**Table 3.2:** Soil fertility metrics across the five Agricultural Development Divisions (ADD) in Malawi. Note: Essential soil testing benchmarks include; organic C = 0.8%; pH = 5.2; Zn = 0.5 mg kg<sup>-1</sup>, Ca = 0.2 cmolc kg<sup>-1</sup>, K = 0.2 cmolc kg<sup>-1</sup>, P = 13 mg kg. (Source: Mutegi *et al.* 2015)

Area	Characteristics				Threshold value (Abdelrahman et al. 2022)
	%>critical	Mean	Minimum	Maximum	
<b>Organic C%</b>					
Mzuzu	72.4	1.2	0.2	3	>5 high
Karonga	80.1	1.3	0.4	3.3	1-5 moderate
Lilongwe	90.6	1.6	0.4	3.3	<1 low
Kasungu	91.8	1.7	0.3	4.6	
Blantyre	77	1.2	0.3	2.9	
<b>pH</b>					<3 strongly acidic
Mzuzu	87.1	5.7	4.4	7.7	3.01-4 strongly acidic
Karonga	87.9	6.2	4	8.3	4.01-5.5 moderately acidic
Lilongwe	66.1	5.4	4.7	6.8	5.51-6.8 slightly acidic
Kasungu	99.2	5.9	4.3	7.2	6.81-7.2 near neutral
Blantyre	78	5.9	5.1	6.9	7.21-7.5 slightly alkaline
					7.51-8.5 moderately alkaline
					>8.5 strongly alkaline
<b>Zn (mg kg<sup>-1</sup>)</b>					>10 high
Mzuzu	92.5	1.4	0.2	5.2	1-10 moderate
Karonga	94	1.8	0	6.4	<1 low
Lilongwe	97.1	1.4	0.2	6	
Kasungu	91.9	1.5	0.1	5.7	
Blantyre	90	1.7	0	9.6	
<b>Ca (cmol kg<sup>-1</sup>)</b>					<2 very low
Mzuzu	98.2	22.3	0.1	5.5	2-5 low
Karonga	99.5	3.1	0.1	6.2	5-10 moderate
Lilongwe	100	4.1	0.8	21	<10 to 20 high
Kasungu	100	1.9	0.2	6	>20 very high
Blantyre	99	3	0.2	9.5	
<b>K (cmol kg<sup>-1</sup>)</b>					<1 very low
Mzuzu	74.1	0.5	0.1	5.1	1-2 low
Karonga	88.5	0.7	0.1	2.5	2-5 moderate
Lilongwe	88.5	0.4	0.1	1.1	5-8 high
Kasungu	83.6	0.5	0.1	1.5	>8 very high
Blantyre	99	1.1	0	13	
<b>P (mg kg<sup>-1</sup>)</b>					>30 high
Mzuzu	57.9	21.7	1	184.1	10-30 moderate
Karonga	58.8	30.1	0.1	163	<10 low
Lilongwe	64.3	31.3	0.6	130.2	
Kasungu	59.3	24.2	0.1	81	
Blantyre	77	45.5	0.9	119	

Soil acidity in Malawi has increased by 20 per cent since 2000 (Vargas *et al.* 2016). This acidification results from a depletion of minerals such as potassium, calcium, and magnesium, as well as the low organic matter levels. Soil acidification is also attributed to the overuse of inorganic fertilisers. Liming and organic amendment are recommended to improve soil pH and nutrient balance (Lakudzala 2013; Munthali *et al.* 2021).

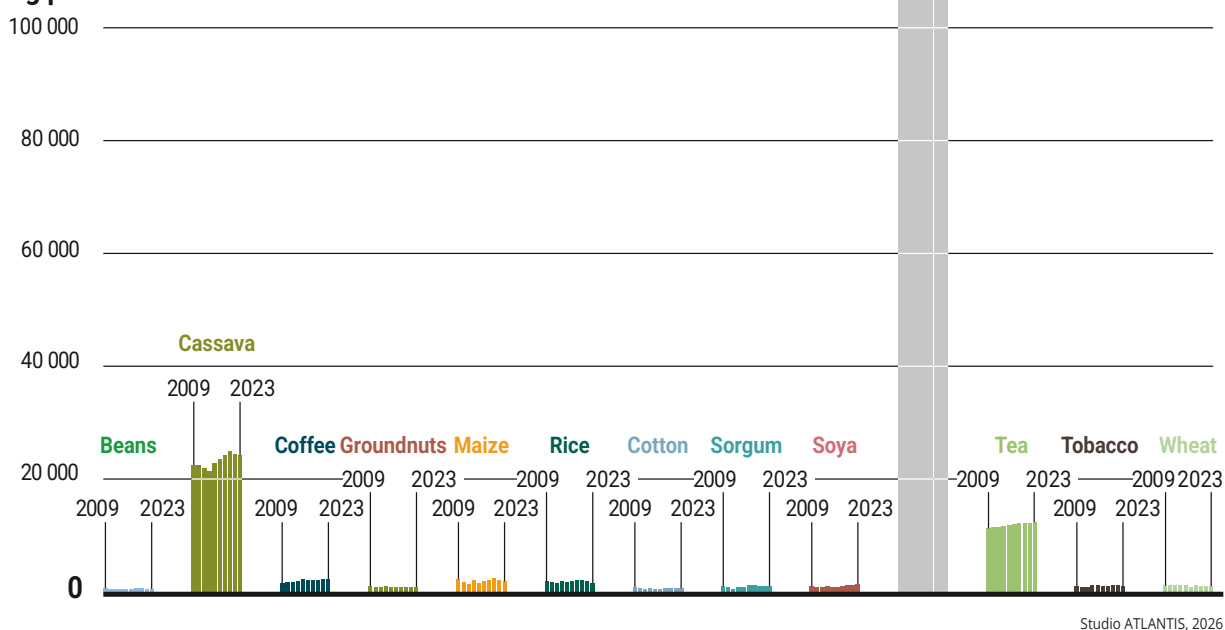
Despite the poor soil health, Malawi has a diverse agro-ecology that supports a range of crops, with maize as the primary staple. However, maize yields on average only 2.5 tonnes per hectare, which is about 25 per cent of potential yield due to declining soil fertility, limited inputs, and variable rainfall (FAO 2024). Production of other crops, such as soybeans, has increased by 138 per cent between

2011 and 2020; driven by inoculation and better fertiliser management (Omondi *et al.* 2023).

Figure 3.6 shows the variability in the yields of different crops. These variable yields are often linked to several factors, including diminishing soil fertility, droughts, poor farming methods, limited access to improved farm inputs (mostly seed and fertilizers), limited access to credit for smallholder farmers, poor extension services, and low market incentives. For instance, maize yields fell steadily between 2014 and 2016, reaching as low as 1.5 tonnes per hectare, followed by a steady recovery between 2018 and 2021. The decline was attributed to late rainfall, flooding in the Southern Regions, and recurring dry periods across the country.

### Crop yield trends

Kg per hectare



Studio ATLANTIS, 2026

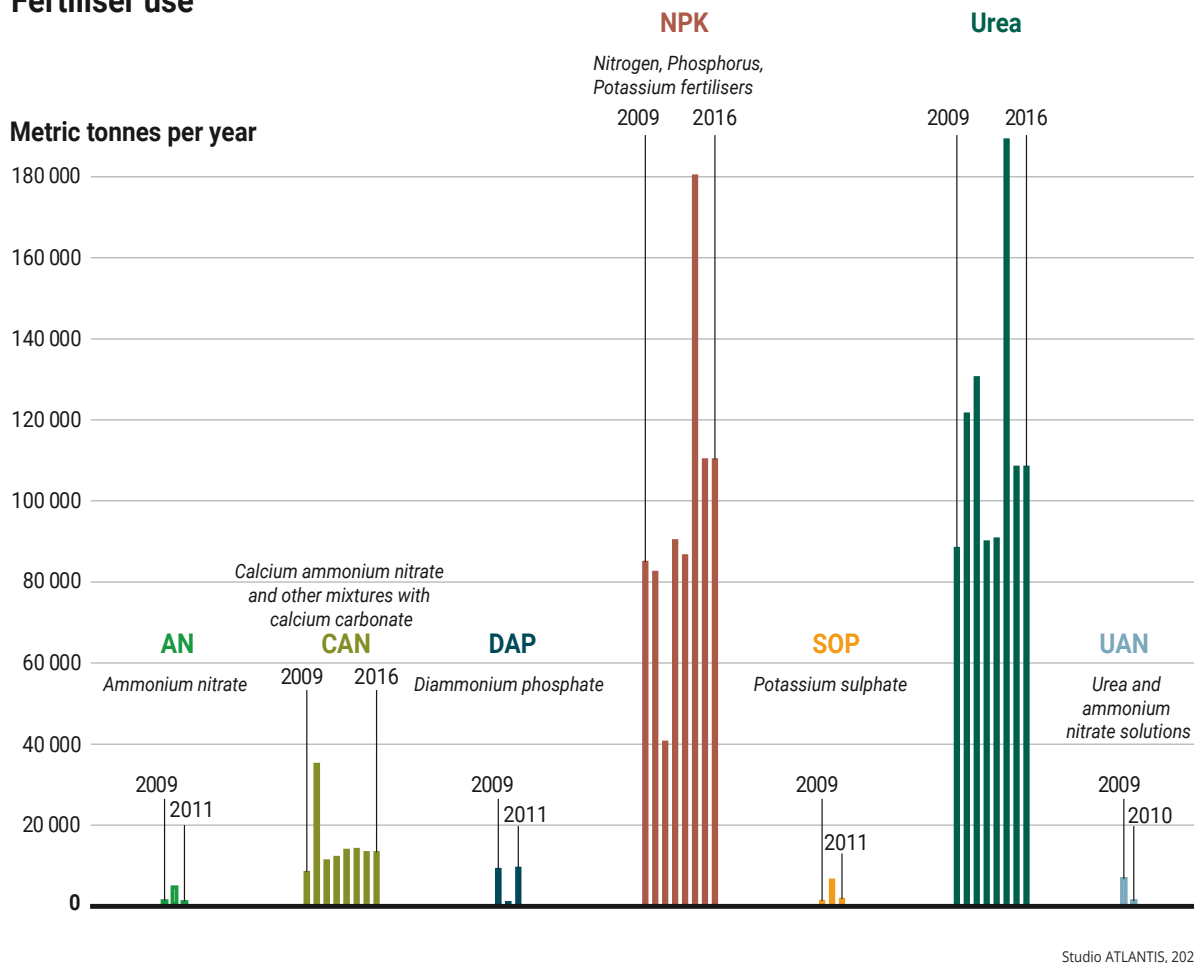
**Figure 3.6:** Different crop yield trends between 2009 and 2023 (FAOSTAT 2024a)



Maize is Malawi's staple food. Photo Horst Vogel.

In order to address the problem of poor soil health, Malawi is witnessing a greater use of inorganic fertilisers as Figure 3.7 shows.

## Fertiliser use



Studio ATLANTIS, 2026

**Figure 3.7:** Inorganic fertiliser usage in Malawi between 2009 and 2016 (FAOSTAT 2024b)

The majority of the soils in Malawi are highly weathered due to little fertiliser use coupled with lack of organic manure input. Most of the soils are deficient in nitrogen, potassium, calcium, sulphur, zinc, boron, and organic matter (Munthali *et al.* 2021). Given such conditions, soil infertility will remain a single major factor contributing to poor crop yields in the country. As a result, fertilisers will remain the most viable and convenient approach to replenishing soil fertility and boost food production. This is consistent with the FAO projections that fertilisers will account for more than half of future advances in food crop yields in countries like Malawi. In fact, maize grain yields of up to 8 tons per hectare have been reported with combined application of nitrogen, phosphorous and potassium, urea, and animal manure (Tamene *et al.* 2015).

Besides the poor soil health, Malawi's low agricultural productivity is also attributed to high dependence on rain-fed agriculture. Recent years have seen irregular rainfall and increased floods due to deforestation in upper

catchment areas. This has resulted in low agricultural output and episodes of food insecurity, such as in 2001 and 2002. In such cases, irrigation forms part of resilient strategies to counteract the effects of unreliable rainfall on crop production output. Some studies reported maize grain yield increases by 30 per cent and total crop productivity by 72 per cent under small scale irrigation in Malawi (Nyirenda *et al.* 2021). In 2000, Malawi had an area of about 56,400 hectares under irrigation against a potential irrigable area of about 407,862 hectares. Due to continued and frequent occurrences of unreliable rains, the government intensified the establishment of irrigation facilities in the country. As of 2015, the total area under irrigation was about 104,000 hectares, representing almost 25 per cent of the total potential irrigable land and almost 84 per cent increase from that reported in the year 2000 (Wiyo and Mtethiwa 2018). Recently, the government of Malawi has embarked on expanding irrigation schemes to cover an additional 43,370 hectares of irrigable land in the Shire Valley of southern Malawi (Government of Malawi 2020).

Soil quality in irrigated land is one key factor that requires careful attention. Irrigating crops using water that contains high concentrations of soluble salts may lead to salinisation, particularly where rainfall is limited or insufficient to wash away the salts. This phenomenon has been observed in flooded areas of the Shire Valley region of Malawi (Malota and Mchenga 2018; Tembo *et al.* 2021). Similarly, Wanda (2013) reported presence of saline irrigation water in Mzimba district of northern Malawi, and that the salinity has been increasing over the years. This indicates that salinity is widespread in irrigated fields of the country, and that urgent measures are needed before the conditions worsen and become more expensive to ameliorate. Salinity can affect crop performance at any growth stage.

### 3.6 Legal and institutional governance frameworks for land

In order to address issues of land access and tenure, as well as land degradation, Malawi has in place interrelated policies and regulative instruments to promote sustainable land management, ensure equitable access, and secure tenure rights. These policies are meant to enhance agricultural productivity, protect the environment, and support socio-economic development.

The National Land Policy (2002) provides the foundation for tenure security and equitable access to land. Its objective is to promote efficient and ecologically balanced use of land and land-based resources while supporting social harmony and economic growth. Despite these intentions, some land degradation and tenure issues are partly reinforced by historical and current land policy structures, as shown in Table 3.3.

**Table 3.3:** Land policy-related challenges and their impact

Land-related challenge	Impact
Historical residual effects	Colonial era policies concentrated land in the hands of a few, leaving a legacy of skewed land distribution that continued to pressure rural communities (Chikaya-Banda and David 2021)
Idle land and mismanagement	Although 4.7 million hectares of land are considered arable, only about 2.5 million hectares are under regular cultivation (World Bank 2019). Poor land development control and speculative hoarding of plots cause artificial shortages, especially in urban and lakeshore areas.
Customary land privatisation	Increasing commercialisation “privatises” customary land and this often excludes vulnerable groups.
Encroachment issues	Cross-border encroachment by immigrants and occupation of protected areas have created additional pressures reflecting weak enforcement of land use regulations.



Rice is mostly grown on wetlands. Photo: Glory Muva.

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Photo: Helle Biseth.



# 04 Freshwater

**Coordinating Lead Authors:** Harold W.T. Mapoma, Daniel Sikawa

**Lead Authors:** Brighton A. Chunga, Daniel Jamu

**Fellow:** Upile Hassan

## Executive summary

**Water availability for safe drinking and adequate sanitation is a significant challenge for Malawi, especially in rural areas** (*well established*). A large section of the population lacks access to safe and clean water for domestic use, particularly in rural areas due to long distances to water sources, variations in rainfall distribution, and high equipment failure rates (approximately 40 per cent) of water supply infrastructure. Per capita water availability declined from 1,400 m<sup>3</sup>/person/year in 2013 to 928 m<sup>3</sup>/person/year in 2017 and is projected to decline to 403 m<sup>3</sup>/person/year by 2050, placing Malawi into the water stress category. The increase in population is leading to increased demands for industry and agriculture, and this often outcompetes access to water for domestic use. The country's water situation is further compounded by unregulated water abstraction. Water in rivers, lakes, and shallow wells is of poor quality and generally does not meet the World Health Organization and Malawi Standards for potable water. While some progress continues to be made in improving access to safe water, sanitation, and hygiene (WASH), about US\$97 million is needed for universal basic coverage and US\$258 million for safely managed services by 2030 {4.2.1.2, 4.2.2.2, 4.2.3, 4.3.3, 4.4.7}.

**Droughts, floods and cyclones are increasing in frequency, negatively impacting Malawi's water resources** (*established but incomplete*). Damage caused by floods, mudslides, and flash floods is evident in some areas in Malawi. Other multiple factors affecting Malawi's freshwater resources include human activities such as mining, agriculture, and industry which lead to pollution

and sedimentation of water bodies, impacting both groundwater and surface water quality. Deforestation and sedimentation from human actions have been noted to influence lake and river levels. {4.1, 4.3.4}.

**Malawi's large rivers and lakes are facing heightened sediment load from land degradation, damaging freshwater ecosystems and reducing reservoir capacity** (*established but incomplete*). High population densities, deforestation, high agricultural development, poor land use practices, and topography worsen conditions for soil erosion and sediment deposits into water bodies. Catchment management systems are vital for sustainable water resources management, especially as climate change increases pressure on supply and demand. The country supports basin planning, catchment rehabilitation, and management through public works and committees to support sustainable water practices. Safeguarding watersheds is crucial for water resource preservation. Integrated water resources management efforts such as the Malawi Watershed Services Improvement Project aim to restore at least 50 per cent of degraded areas in major river basins such as Shire, Linthipe, Bua, Dwangwa, North Rukuru, and Lufilya {4.2.1.2, 4.4.8}.

**Transboundary waters, shared by at least two countries, account for the bulk of Malawi's freshwater inflows, including into Lake Malawi and Shire River** (*well established*). The effective use and management of Malawi's shared water resources requires coordination, information and data sharing, and policy harmonisation with its neighbours. {4.4.1, 4.4.2}.



Most rural communities access drinking water through boreholes and wells. Photo: ILRI.

## 4.0 Introduction

Malawi is rich in water resources. These water resources include those found in lakes such as Lake Malawi and Lake Chilwa, lagoons such as Chia Lagoon and Chikukutu Lagoon, swamps and marshes such as Elephant Marsh and Vwaza Marsh, rivers that include Shire River and Ruo River, and groundwater systems. The Shire River, which flows from Lake Malawi through Lake Malombe to the Zambezi River in Mozambique, is significant for freshwater systems in Malawi; discharging about 12.5 km<sup>3</sup> through the basin annually (International Lake Environment Committee 2006).

While Malawi has abundant renewable water, estimated at 17.3 km<sup>3</sup> per year, the country faces challenges in water availability for domestic use, with decreasing per capita renewable water availability, placing the country in a water stress category (Hughes 2019). This water stress results from population growth, climate variability, and poor storage and distribution infrastructure; affecting agriculture, industry, and public health (Bronstert, Mtilatila and Vormoor 2024; Kachaje, Chisanu and Liangjun 2017).

Water in Malawi is mainly replenished through rainfall. Human activities causing pollution and deforestation harm water resources. These conditions, alongside extreme

weather events, worsen water quality and often lead to disease outbreaks such as cholera (Jung *et al.* 2023). Recent heavy rainfall cycles caused by La Niña (Mloza Banda, Cornelis and Mloza Banda 2024) and cyclones (Braka *et al.* 2024) have raised groundwater levels, but also caused mudslides, flooding, and contamination of surface water, with severe economic impacts.

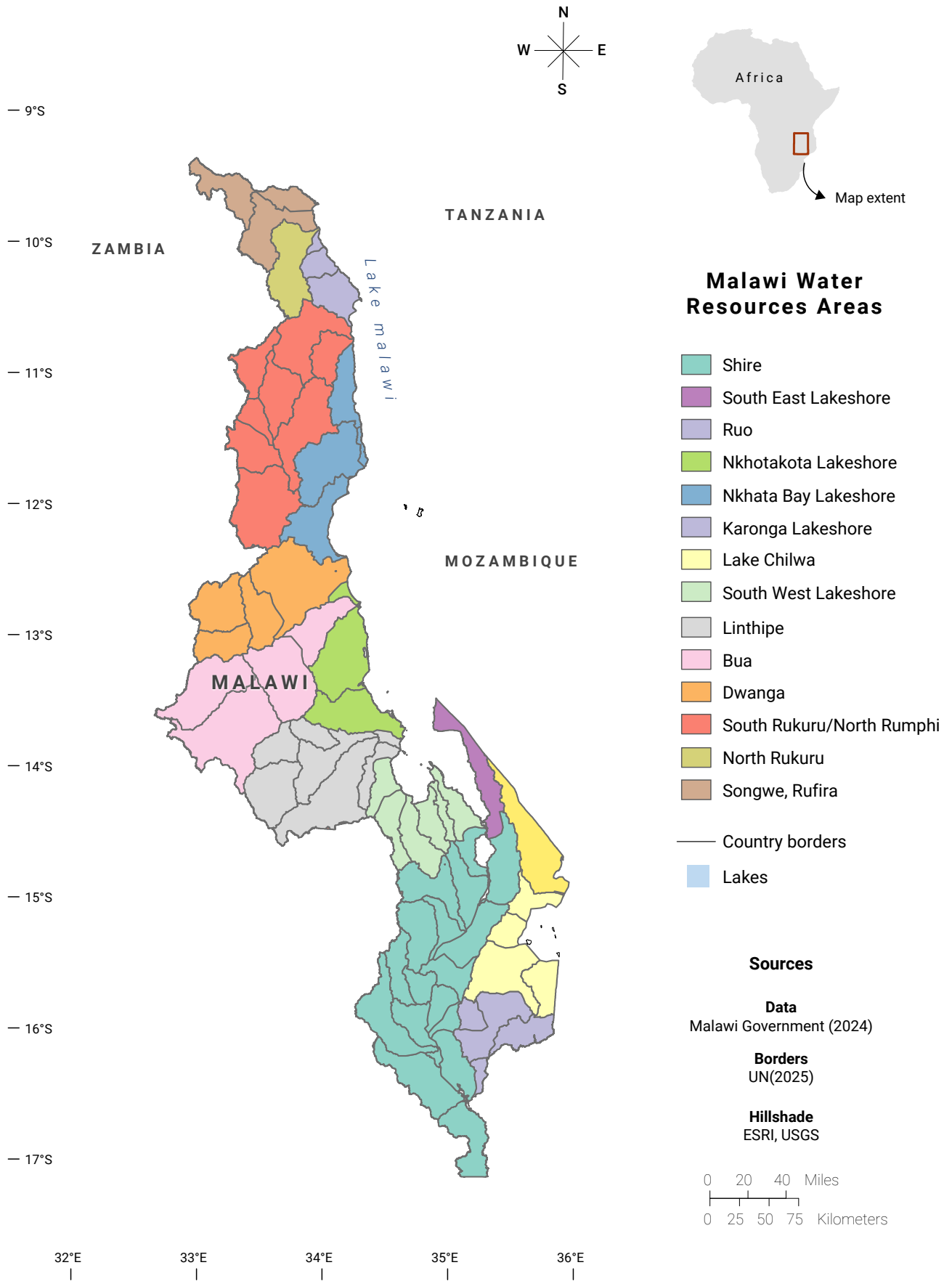
The economic burden of degraded water resources in flood-prone areas is significant. For example, flood damage costs in 2019 were estimated at US\$57 million (Hughes 2019), affecting Malawi's capacity to meet its developmental. This situation emphasises the need for sustainable water resource management and environmental protection to ensure the availability of freshwater for future generations.

## 4.1 Surface water resources and quantity

Malawi's surface and groundwater resources are grouped into 17 water resources areas in which each water resource area (WRA) represents one hydrological basin, as shown in Figure 4.1 and Table 4.1. These WRAs are further subdivided into 78 local sub-catchments for ease of Integrated Water Resources Management planning and implementation as required under the Water Resources Act (2013).



Heavy rainfall is the primary cause of flooding in Malawi. Photo: Horst Vogel.



**Figure 4.1:** Water Resources Areas in Malawi

**Table 4.1:** Water Resources Area sizes, categories and its location

Water Resource Areas	Region	Area (km <sup>2</sup> )	Water Resources Units
1. Shire	Southern and Central	18,945	16
2. Lake Chilwa	Southern and Central	4,567	4
3. South West Lakeshore	South	4,998	5
10. South East Lakeshore	South	1,659	1
11. Lake Chuita	South	2,443	1
14. Ruo	South	3,519	4
4. Linthipe	Central	8,885	6
5. Bua	Central	10,658	4
15. Nkhotakota Lakeshore	Central	4,819	3
6. Dwangwa	Northern and Central	7,751	4
7. South Rukuru, North Rumphu	Northern	12,719	7
8. North Rukuru	Northern	2,088	1
9. Songwe, Lufira	Northern	3,730	2
12. Lakoma Island	Northern	17	1
13. Chizumulu Island	Northern	3	1
16. Nkhata Bay Lakeshore	Northern and Central	5,533	3
17. Karonga Lakeshore	Northern	1,945	3

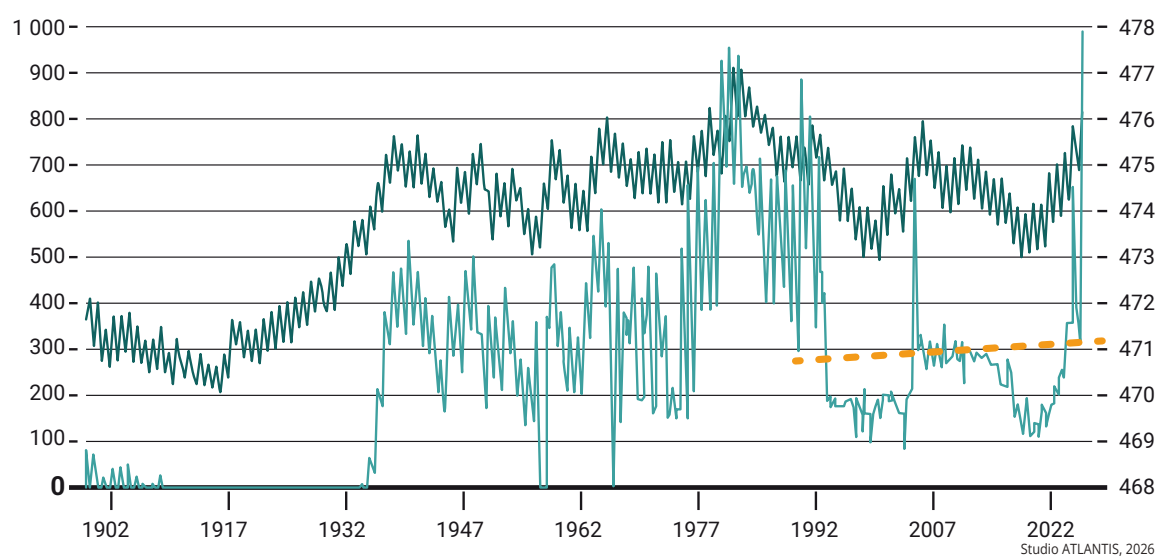
#### 4.1.1 Lakes

In Malawi, surface water resources consist primarily of lakes, rivers and reservoirs, with Lake Malawi, the third largest lake in Africa, holding most of the country's surface water. The country's hydrology is shaped by major rivers such as the Shire, North Rukuru, South Rukuru, North Rumphu, Songwe, Linthipe, Dwangwa, Ruo, and Bua. Except for the Shire and Ruo, most of the rivers drain into Lake Malawi and support the country's agriculture, fisheries, energy, and domestic water supply.

The Lake Malawi system is the most prominent hydrological feature in the country. Bounded by Malawi, Mozambique and Tanzania, Lake Malawi is 560 km long and averages around 50 km in width (Johnson and Davis, 1989). The surface area of Lake Malawi ranges between 28,750-30,800 km<sup>2</sup>, and a volume of approximately 7,725 km<sup>3</sup> (Drayton 1980; 1984). The Shire River drains out of the lake. On average, the Shire River flow rate fluctuates around 450 – 500 m<sup>3</sup>/s, which helps to regulate Lake Malawi's water levels (Chisala and Kansake 2003) Figure 4.2 shows the lake level trends (1900 – 2024) as measured at Kamuzu Barrage (Liwonde). The other major lakes in Malawi include Lake Chilwa, Lake Malombe, Lake Chiuta, and Lake Kazuni, the areas and volumes of which are described in Table 4.2.

## Hydrological Condition

### Flow at Liwonde m<sup>3</sup>/w



**Figure 4.2:** Malawi Lake Levels and Shire River water flow regime measured at Liwonde barrage (Nkwanda et al. 2021).

**Table 4.2:** Other Lakes in Malawi

Lake	Area (km <sup>2</sup> )	Volume (km <sup>3</sup> )	Location (Districts)
Chilwa	683	1.8	Machinga, Phalombe and Zomba.
Malombe	303	1.013	Mangochi
Chiuta	60	0.225	Machinga
Chia Lagoon	20	-	Nkhotakota
Kazuni	4.6	-	Mzimba and Rumphu
Chiwondo and Mlare	2.17	-	Karonga

### 4.1.2 Rivers

The country's surface water quantity is also held in highly extensive river systems. The main river systems in Malawi include Shire, Linthipe, Bua, Songwe, Dwangwa, Ruo, North Rukuru, South Rukuru, North Rumphu, Mwanza, and Wankulumadzi, which also have numerous annual and perennial tributaries. Most of these rivers (the Songwe, Linthipe, Bua, Dwangwa, North Rukuru and the South Rukuru) drain their water into Lake Malawi with inflows of about 360 m<sup>3</sup>/s (Republic of Malawi 2015). As the Shire River flows out of Lake Malawi into the southern region, it is joined by two major tributaries, Ruo and Mwanza Rivers, which greatly influence water quantities in the Shire River, particularly in Lower Shire. Like the lakes, the quantity of surface water resources in rivers is highly dependent on the availability of rainfall, which sustains runoff. In these rivers, surface water resources are more abundant during the rainy season than during the dry season. Additionally, the quantity of surface water in Malawi is predominantly influenced by various other factors, the key being climate

change and anthropogenic activities. Anthropogenic activities have significantly impacted the environment and altered natural processes and ecosystems. In Malawi, the key anthropogenic activities having significant impacts on water resources include agriculture, urbanisation, and construction, which bring immense land use changes, waste, and pollution.

### 4.1.3 Reservoirs

Malawi has numerous artificial reservoirs that have been constructed for hydropower generation, urban and rural water supply, and irrigation. Hydropower generation reservoirs are located on the Shire River at Nkula A and B, Tedzani and Kapichila, and on the Wovwe River. Planned hydropower generation reservoirs include Mpatamanga on Shire River, Lower Fufu, and Songwe rivers. The main drinking water supply reservoirs include Kamuzu Dam I and II on Lilongwe River, Mpira, Mulunguzi, Lunyangwa, and Mudi with a total storage of over 43 million cubic metres. In addition to these major reservoirs there are over 700

small reservoirs in Malawi that were primarily developed for irrigation with a storage capacity of approximately 64 million cubic metres (Food and Agriculture Organization (FAO) 2006).

Deforestation, unsustainable agriculture practices that cause soil erosion, urbanisation, and climate change are some of the major factors affecting the functionality and sustainability of these reservoirs. For example, Mwimba Reservoir in Kasungu, whose original design volume is 89,200 m<sup>3</sup>, declined by 18.2 per cent over a 5-year period to a volume of 72,966 m<sup>3</sup> (Kumambala *et al.* 2025). Policy conflicts also have contributed to reduced functionality and capacity of reservoirs. For example, Chiwembe and Chimwankhunda Dams have completely silted due to conversion of its catchment from forestry to urban housing and commercial development (MBC online 2022). Similarly, conflicting policies and strategies between the Departments of Forestry and Water contributed to the reduction of water supply capacity of the Mpira Dam due to harvesting of trees in the Mpira Catchment (Times online 2015).

Climate change has significant effects on surface water quantities in Malawi. Extreme climate conditions have seen some of Malawi's perennial rivers drying up or increased water flow and levels in both rivers and lakes. For instance, due to increased rainfall, Lake Malawi water levels have increased significantly, reaching the second-recorded highest-level of 475.7 metres above sea level in the 2023/2024 hydrological cycle and the third highest level (475.03 meters above sea level) was recorded during the 2020/2021 hydrological year. The highest, 477.22 meters above sea level, was recorded in 1980. The impact of climate change continues to influence rainfall characteristics. Studies predict a wide range of changes in annual rainfall, evapotranspiration, surface runoff, and water yield in many rivers and lakes in Malawi by the 2050s. These predicted changes include a -5.4 per cent to +24.6 per cent variation in annual rainfall and a -7.5 per cent to over +50 per cent change in annual surface runoff and water yield, with notable regional differences (Adhikari and Nejadhashemi 2016). These changes are expected to greatly impact surface water quantities in Malawi.

#### 4.1.3 Land use change impacts

Land use changes, particularly the conversion of natural forests to agricultural land, impact surface water quantities significantly. The expansion of built-up areas, agricultural land, and deforestation cause an increase in soil erosion and surface runoff in many rivers and lakes in Malawi. For instance, a study on Lake Malawi showed that deforestation led to significant changes in lake levels, with a decrease in forest cover resulting in higher lake levels during drought periods (Calder 1995). A similar

study which was carried out in the Rivirivi River basin, one of the major tributaries of the Shire River, indicated that the 65 per cent reduction in the forest cover from 1992 to 2008 increased high flow index by 16 per cent and the number of zero-flow days (Chimtengo *et al.* 2014).

#### 4.1.4 Sediment impacts

Sediment issues are quite evident in many catchments across Malawi. Soils which are constantly being eroded from agricultural, built up, and deforested areas tend to reduce the volume of river channels, reservoirs, and lakes, consequently impacting the volume of water. Higher sediment concentrations, loads, and yields are observed in densely settled catchments with extensive agricultural activity, while lower values are found in small, steep catchments with a high proportion of intact forest. Fuelled by climatic and hydrological changes, riverbed siltation is quite visible in areas such as Nkhotakota lakeshore, the Shire Valley, central Karonga, Central Region Plateau, and most rivers that flow into Lakes Chilwa and Malawi. Lyons *et al.* (2011) observed that Lake Malawi has experienced significant lake-level fluctuations which are marked by changes in sediment patterns, with coarse-grained sediment and organic matter flux increasing when precipitation and runoff are high.

## 4.2 Surface water quality

Surface water is abstracted directly from rivers, lakes, and dams for domestic, industrial, and agricultural use. Surface water also serves critical ecosystem functions such as supporting aquatic biodiversity and productivity, tourism, and culture. Good surface water quality that meets national and international standards is necessary for sustaining human health, supporting ecological functions, and for utilisation as an input to industrial, domestic, and agricultural uses. There is very little information on the parameters that are used to assess the suitability of surface water for irrigation and to monitor water contamination by agrochemicals, largely because there are no standards provided for such purposes in the country.

Surface water quality from rivers, lakes and shallow wells has been shown to be poor and generally exceeding World Health Organization (WHO) guidelines and Malawi Standards (MS) for potable water (Mweta *et al.* 2022; Table 4.3). Water quality monitoring for pesticide residuals is also absent in all major rivers even though the Government of Malawi acknowledges that pollution of waterbodies, air, soil, and food due to improper handling, storage, and disposal of pesticides is of high concern (Government of Malawi 2010).

Table 4.3 provides a summary of the state of water quality in selected surface water environments in Malawi.

**Table 4.3:** Table summarising surface water quality results for various water bodies.

Water Quality Parameter	Water Body							
	Limit	Malawi	Chilwa	Malombe	Likangala	Lilongwe	Mudi	Shire
SRP (mg/L)	0.02	0.15-0.86	NA	0.01	NA	NA		
Phosphate (mg/L)	10	5.89-7.95	2.95	6.9	1.5-10.7	148	0.5-5.6	15.5-23.6
TDS (mg/L)	450-1000	500	1921	1240-1500	50-273	60	153-560	
Nitrate (mg/L)	50	50	17.8	3.9-7.9	12.4	75	83-136	<0.1
Turbidity (NTU)	<25	25	141	19.6-21.5	97.7	10-1158	12.6-1016	42-59
pH	6.5-9.5	6.5-9.0	8.6	7.4-7.6		6.7	7.7-8.5	
Electrical conductivity (µs/cm)	<3500	3500	15000	165.3	864	400	155-568	<200
Faecal coliform (cfu/100ml)	0	0-21000	1015	77	14739	20408	640-3360	96.149
Fluoride (mg/L)	1.5	2.0	40-42		2.1	NA		
Sulphate (mg/L)	400	5.7	2.9	0.63	1.94-11.6	NA	5-88.5	4.4
Sodium (mg/L)	200	80	328.4	14.4	20.2	24.3	NA	6.4
Potassium (mg/L)	10	6.4	12.4	245	3.1	NA	NA	15

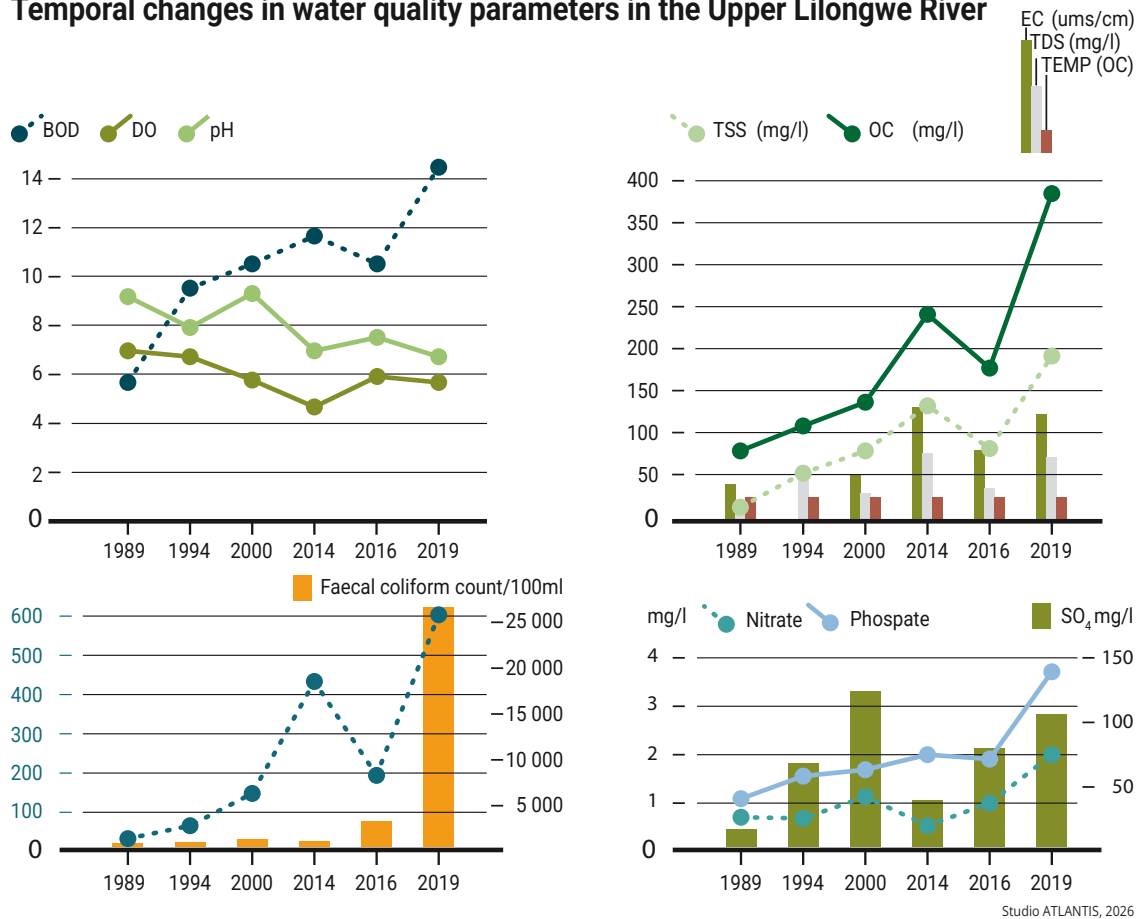
Surface water quality varies in time and space. In Blantyre, Chiradzulu, and Mulanje districts in southern Malawi, Pritchard *et al.* (2007) showed that total coliform (TC) and faecal coliform (FC) values in the wet season (February and April 2006) were much higher than those in the dry season (August and October 2005). Chikabvumbwa *et al.* (2021) showed substantial water quality deterioration in

Upper Lilongwe River (Figure 4.3), which was attributed to increased sewage effluents and surface runoff from non-point sources such as agricultural land, grazing land, settlements, urban areas, and point source such as industry. Similar water quality trends observed in the Upper Lilongwe River catchment were noted in various other rivers (Pullanikkatil *et al.* 2016).



Communities are encouraged to collect rainwater for future use. Photo: Horst Vogel

## Temporal changes in water quality parameters in the Upper Lilongwe River



**Figure 4.3:** Temporal changes in water quality parameters in the Upper Lilongwe River (Nkwanda *et al.* 2021)

Urban rivers are prone to pollution from city and industrial waste, while rural rivers are mainly affected by non-point agricultural contaminants. Spatial changes in water quality have been observed along the shores of Lake Malawi where residents depend on nearshore water for drinking, cooking, and bathing. At 15 m from the shoreline, *E. coli* concentrations dropped by between 0.3 to 17 per cent of shoreline values. Tyner *et al.* (2018) reported that 90 per cent of water samples from the Lake exceeded the WHO drinking water standard of 0 colony forming unit (CFU)/100 ml. Microbial contamination of lake waters affects the quality of fish if it is not properly handled after harvesting and processing. FISH (2018) showed that improperly handled fish stored in the boat keel where the fish was in contact with inshore water had higher levels of total coliforms, *E. coli* and *Salmonella* compared with fish stored in containers. This suggests that poor lake water quality has implications for fish quality and food safety in addition to the negative impacts of the consumption of contaminated water on human health.

Pesticide and herbicide use in Malawi has generally shown an increasing trend since 2010, especially in crop production like sugarcane, tea, macadamia, and horticulture. The emergence of fall armyworm in maize and rising labour costs in small-scale agriculture has also resulted in increased use of pesticides and herbicides,

respectively. Pesticide residues can contaminate surface and groundwater, affecting the quality of water for human consumption and the environment. Several studies have noted the growing trend in the use of agro-chemicals and their negative impacts on surface water quality in rivers in Malawi (Kamwala 2024; Kanyika-Mbewe *et al.* 2020; Kasambala *et al.* 2018).

Deforestation and poor agricultural practices increase runoff and soil erosion, leading to elevated levels of total suspended solids and nutrients in river discharge. This in turn leads to increased sediment and nutrient loading in Malawi's lakes (Kingdon *et al.* 1999). The use of fertiliser and indiscriminate disposal of metal products contributes to pollution. Rivers that flow through urban spaces such as Lilongwe, Likangala, Mudi, and Limbe show elevated concentrations of pollutants that are attributed to the effluent discharge from industries and wastewater leakages from sewer systems due to poorly functioning or non-existent wastewater treatment plants and poor enforcement of pollution control and wastewater management measures by authorities.

The Malawi Agenda 2063 puts emphasis on the development of irrigation infrastructure to reduce dependence on rain-fed subsistence agriculture and enhance agricultural productivity through efficient,

sustainable, and reliable irrigation. Surface water quality in rivers and lakes must be evaluated for its suitability for irrigation and aquaculture. Wanda *et al.* (2014) reported high salinity in sampled shallow wells in Mzimba district, which made water unusable for irrigation. Surface water quality assessments for selected rivers (Balaka and Chagoma 2022; Jamu *et al.* 2012; Kingdon *et al.* 1999) indicate that river quality is heavily impacts fisheries productivity, especially for species such as *Opsaridium microlepis* (mpasa), *Barbus sp.*, and *Enteromius sp.* that require riverine environment to spawn.

There is a need to intensify the implementation of long-term integrated water resource management activities to restore and sustain the provisioning and regulating functions of watersheds, ensuring the sustainable availability of good quality water for multiple uses in Malawi. The Watershed Services Improvement Project is one such effort to address integrated water resources management (IWRM). The main aim of the project is to increase the adoption of sustainable landscape management practices and improve watershed services in targeted watersheds of the Shire River Basin, Linthipe, Bua,

Dwangwa, North Rukuru, and Lufilya basins, with a target of restoring at least 50 per cent of degraded landscapes in priority catchments.

### 4.3 Groundwater resources and quantity

Groundwater is an essential resource for over 60 per cent of the country's population who rely on it for domestic and industrial use. Although groundwater overreliance is very prominent in rural areas, due to increased informal settlements in the country's urban areas, groundwater is also becoming one of the major sources of water supply in various urban dwellings. This has led to an increase in water abstraction points from approximately 38,000 in 2012 to 85,327 by 2022 (Kalin *et al.* 2022).

The quantity of groundwater varies across the country. In general, Malawi's geological characteristics consisting of consolidated sedimentary rock, unconsolidated sedimentary rock overlaying weathered basement, and weathered basement overlaying fractured basement. Important rock formations for groundwater as described in Table 4.4.

Table 4.4: Aquifer groups in Malawi

Aquifer Group	Description	General effect on Water Quality	Key Processes
Consolidated sedimentary rock	Consolidated sedimentary rocks of various compositions including sandstones, marls, limestones, siltstones, shales, and conglomerates. Groundwater is transmitted via fissures, fractures, joints, and intergranular pore spaces.	Quality improvement; acts as a natural filter	Denser, less permeable rocks (like shale or sandstone) slow water movement, filtering out suspended solids and allowing time for some chemical attenuation. However, certain rock types can introduce dissolved minerals like calcium, magnesium, or iron, increasing hardness.
Unconsolidated sedimentary rock overlaying weathered basement	All unconsolidated sediments including sands, gravels, lacustrine sediments, colluvium, alluvium, and fluvial sediments. Groundwater is transmitted via intergranular pore spaces. Name indicates that all sediments are generally deposited onto weathered basement aquifers at variable sediment depths.	Variable quality; often high turbidity.	The high porosity and permeability of materials like sand and gravel allow water to flow quickly, making the aquifer vulnerable to surface contamination (e.g., agricultural runoff, septic systems).
Weathered basement overlaying fractured basement	Weathered basement overlying fractured basement at variable depths. Groundwater is stored and transmitted via intergranular pore spaces in the weathered zone, and mainly transmitted via fractures, fissures and joints in the fractured zone.	Introduction of specific minerals	Chemical weathering of the original granite or other basement rock can introduce elements like iron, manganese, or even trace amounts of heavy metals into the water as minerals dissolve.

Source: Kalin *et al.* 2022; Mapoma *et al.* 2017b.

The Hydrogeology and Groundwater Quality Atlas of Malawi estimates that the country's groundwater volumes range from 96,656 to 1,108,340 million cubic metres. The total recharge into all aquifer units' ranges between 1,031 and 7,731 million cubic metres per year. (Kalin *et al.* 2022)

Groundwater quantity in Malawi suffers unsustainable withdrawal rates, especially near urban areas where the resource is not just for domestic uses but also for small-scale industries. Climate change, which has altered rainfall and evaporation rates, is also reducing groundwater recharge in many areas across the country, consequently impacting the overall quantity. The recharge is also greatly impeded in areas where natural vegetation has been cleared due to settlement expansion, agriculture, and deforestation, as areas cleared of vegetation tend to experience high runoff rates and reduced infiltration.

#### 4.4 Groundwater quality

An assessment of the status of groundwater quality in Malawi is important because a large majority of rural Malawians depend on groundwater from boreholes and shallow wells for household use (Holm *et al.* 2018;

Mapoma *et al.* 2017a; Mapoma *et al.* 2016). Groundwater is also increasingly becoming an important source for irrigation due to low and seasonal availability of surface water and the availability of low-cost solar-powered irrigation systems (Wamalwa 2024; Kamwamba-Mtethiwa 2016).

Groundwater quality is influenced by anthropogenic and geogenic processes. Anthropogenic processes include leaching of agricultural and industrial effluents into the soil, as well as microbial contamination of groundwater due to pit latrine loading (Table 4.5). The anthropogenic impacts of groundwater pollution are higher in unconfined alluvium aquifers and prone to ionic contamination by surface waters. Geogenic processes lead to elevated ionic concentrations such as salinity, fluoride, iron, sulphate and chlorides. Nyirenda *et al.* (2015) raised concerns on the turbidity of groundwater in the Lakeshore districts of Salima and Nkhotakota due to both anthropogenic and geogenic processes. It is inferred that various human activities can be used to map the variations in the quality of groundwater in an area (Mapoma *et al.* 2017a) which may assist in identifying solutions.

**Table 4.5:** Calculated pit latrine loading trends in the Nkhata Bay lakeshore area (Water Resource Area 16 (Source: Kalin *et al.* 2022)

	Population				Projection	Latrine fecal sludge	Cumulative Sludge loading	
	Calculated Number of Latrine users							
Water Resource Unit	Year 2011-2012	Year 2013-2014	Year 2015-2016	Year 2017-2018	Year 2019-2020	Year 2021-2022	Total Volume over 10-year period (Litres)	Estimated Total Loading (Metric tonnes faecal sludge 2012-2022)
16E	87,951	89,274	96,109	101,005	104,240	99,721	312,281,733	374,738
16F	115,717	121,587	128,837	137,024	141,586	139,274	423,373,438	508,048
16G	58,740	56,980	58,466	59,616	59,923	59,660	190,827,595	228,993
WRA 16	262,408	267,841	283,412	297,645	305,749	298,655	926,482,766	1,111,779

Table 4.5 illustrates that the generation of faecal sludge is increasing over the years, yet on-site sanitation is dominant in Malawi. Sewer systems are limited to small portions of high-income areas, with over 90 per cent of residents in informal settlements relying on on-site sanitation, primarily pit latrines. Some of the faecal sludge is transported to city wastewater treatment plants for co-treatment with wastewater, but these facilities often receive only a fraction of the total collected sludge. The majority of faecal sludge bypasses formal treatment systems, often ending up in the environment. This may contribute to the public health burden in the country.

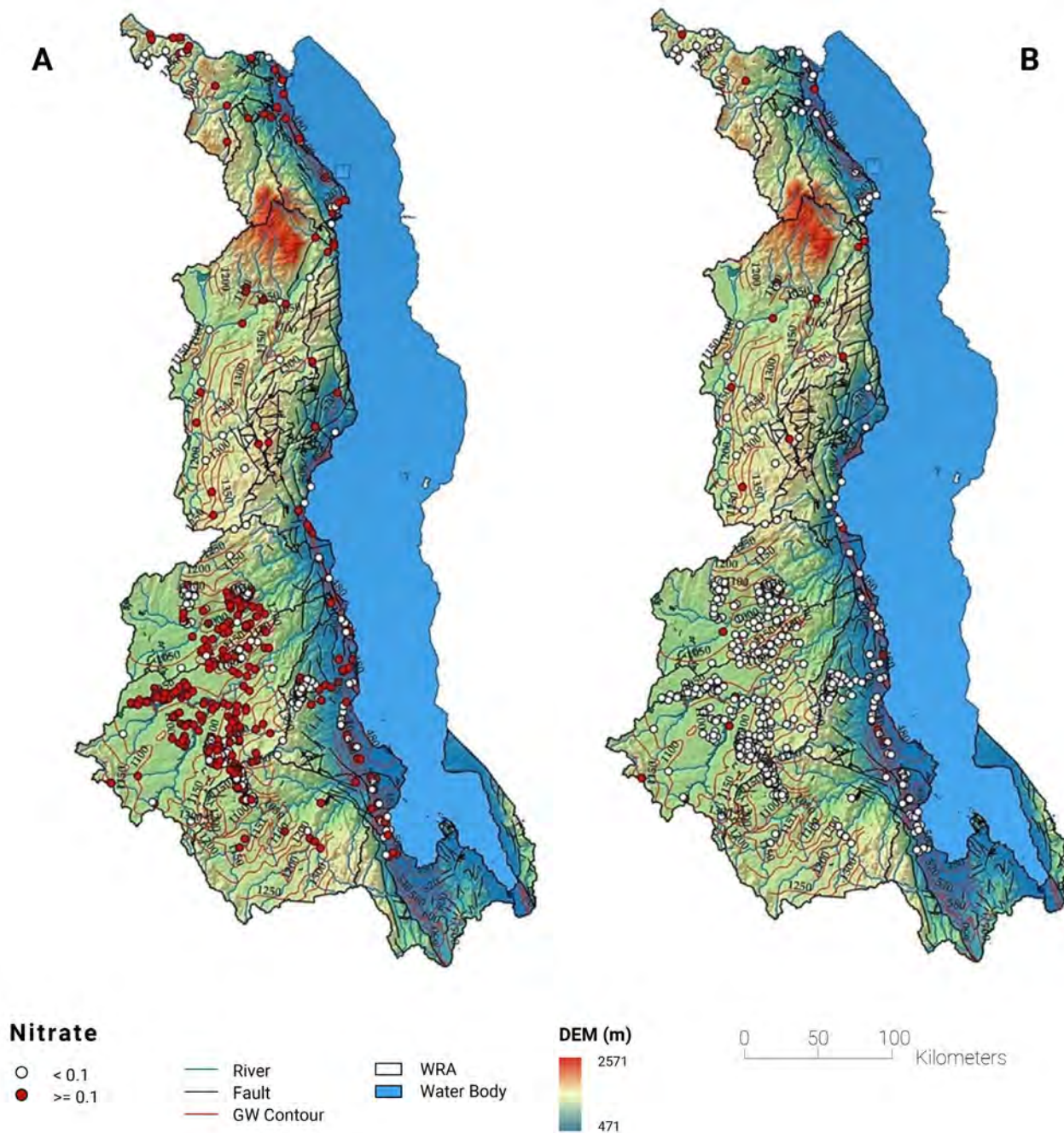
Banda *et al.* (2024) show that anthropogenic activities have resulted in elevated nitrate concentrations in

ground water in the Lake Malawi basin which cannot be traced to geogenic processes (Figure 4.4). The observed elevated groundwater nitrate concentrations highlight the widespread human impact of extensive fertiliser use, surge in pit latrines, and septic tank systems on groundwater quality.

The high-water ionic concentrations in Lake Chilwa; particularly the high salinity, total dissolved solids (TDS) and sodium concentrations in the bases; are influenced by geological lacustrine deposits. These high ionic concentrations relative to surface water strongly indicate the need to develop surface water sources with low TDS and salinity for potable water in the basin. Monjerezi and Ngongondo (2012) reported that the presence

of highly mineralised groundwater in the Lower Shire rendered groundwater resources in large areas unsuitable for domestic and irrigation purposes. Good quality groundwater is found in the Karoo basalts, Precambrian

basement complex, and their derived sediment found in their vicinity and away from the saline groundwater zones (Monjerezi *et al.* 2012).



**Figure 4.4:** Spatial distribution of nitrate concentrations in groundwater across the LMB. (a) shows general distribution of measurable nitrate and (b) shows measurable nitrate concentration projecting potential (Banda *et al.* 2024).

## 4.5 Water resources availability and access

Although Malawi is rich in water, water availability and access are shaped by many factors such as climate, geography, technology, and socio-economy.

Lake Malawi, which spans close to a fifth of the country's area and supports a variety of needs, from drinking water to agriculture and hydropower generation, is the largest and most crucial source of surface water resources. Lake Malawi, which spans close to a fifth of the country's area and supports a variety of needs, from drinking water to agriculture and hydropower generation, is the largest and most crucial source of surface water resources. Rivers, particularly the Shire River, further contribute to the country's surface water reserves. Many rivers are seasonal and affected by rainfall patterns. In the rural communities where piped water systems from surface water bodies are less accessible, groundwater sources are the most important. Groundwater availability in Malawi also varies depending on geological as well as climatic factors.

In addition to the geological differences, rainfall patterns in Malawi are highly seasonal, with most precipitation occurring between November and April, leading to variations in surface water levels and recharge rates for aquifers. The commonly observed rain-bearing systems in Malawi include the Inter-Tropical Convergence Zone (ITCZ), the Congo air mass, easterly waves, and tropical cyclones (Government of Malawi 2023). According to Kelly *et al.* (2020), rainfall in Malawi ranges from 700 to 2400 mm, with a mean annual rainfall of 1095 mm. The distribution of rainfall also varies based on topography and proximity to Lake Malawi. Because of these variations, therefore, seasonal reliance on rain makes Malawi vulnerable to droughts, which periodically limit water availability for agriculture, drinking, and other uses, as both surface and groundwater decline.

In line with the United Nations Sustainable Development Goal 6.1, Malawi seeks to increase water accessibility for all by 2030 through the expansion of water points infrastructure. At the national level in 2020, 70 per cent of the population in Malawi had at least basic access

to improved water supply services (having an improved water source within a round trip walking distance of 30 minutes), and 22 per cent had access to limited services (improved source at a distance of more than 30 minutes round trip). In contrast, nearly 6 per cent of households lack access to improved water sources, while 2.2 per cent draw their water directly from surface water (WHO and UNICEF 2021).

Although significant strides have been made to increase water accessibility, it is noted that this apparent significant improvement is suppressed by the high equipment failure rates of water supply infrastructure. About 26 per cent of handpumps on boreholes were observed to be non-functional in 2016 (Mkandawire *et al.* 2020). A later mapping of water points in rural Malawi in 2020 further showed that only 60 per cent were functional (Sanitation and Water for All 2022), indicating a worsening of equipment failure. The non-functional state of boreholes has mostly been attributed to old equipment, catchment deterioration, neglect, lack of spare parts and inadequate community-based water management structures. As a result of this unfortunate state, women and children shoulder the burden of poor access to water services as they often walk long distances to collect water.

## 4.6 Competition for water

Even though Malawi has vast freshwater resources, the country often experiences chronic water shortages in some parts due to disparities in water distribution. The main competing uses of freshwater in Malawi include domestic use for public water supply and sanitation, hydropower generation schemes, irrigation and navigation.

Agriculture is the major water consumer in the country through irrigation, with plans for greater use through the Green Belt Initiative in Malawi which aims to expand irrigation to 485,000 hectares by 2035 (Government of Malawi 2011). Table 4.6 shows a summary of current water use projections to 2035, with agricultural use ratio expected to increase from 77 per cent in 2010 to 86 per cent in 2035 (Malawi, Ministry of Agriculture, Irrigation and Water Development 2012).

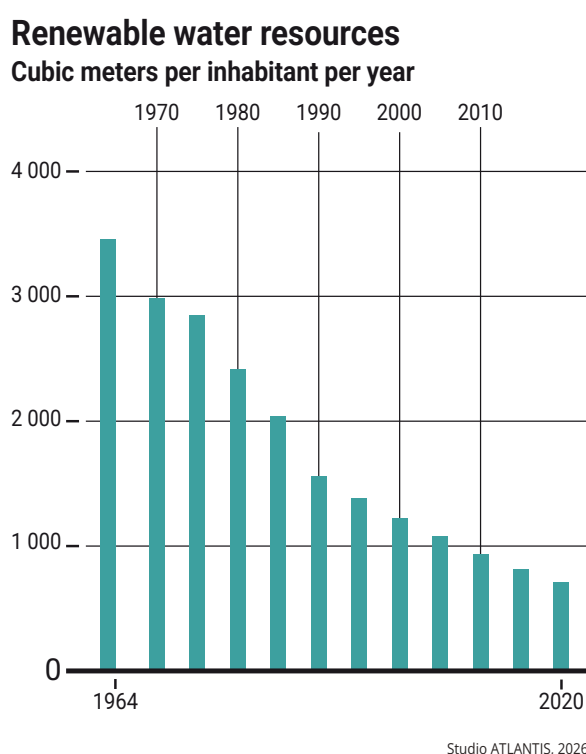
**Table 4.6:** Composition of Water Demand in Malawi, 2010 and 2035 (Malawi, Ministry of Agriculture, Irrigation and Water Development 2012)

Component	Percent of National Demand (Annual average basis)	
	Demand Component 2010	Demand Component 2035
Domestic	16	8
Arable Agriculture (irrigation)	77	86
Livestock Agriculture	2	1
Commercial	2	2
Institutional	1	1
Mining	>1	1
Unaccounted for Water (UFW)	2	2

Hydropower generation competes with irrigation demands, affecting energy and food security, while industrial activities, such as mining, compete with environmental flows and ecosystem needs.

Despite the abundant water resources in Malawi, per capita water allocation seems to be on the decline. Based on the report by Worldometers (2018) on Malawi’s water resources, by 2017 water resources allocation per capita was estimated at 928 m<sup>3</sup>/person/year, a decline from the 1400 m<sup>3</sup>/person/year in 2013. Figure 4.5 shows that, since 1962, per capita water allocation continues to decline. Based on this trend, per capita allocation may have declined to 403 m<sup>3</sup> by 2025. Due to increased population growth, municipal, agricultural, and industrial usage has

drastically increased. For instance, Figure 4.6 shows that water allocation for the agricultural sector increased from 0.809 billion cubic meters in 1994 to 1.166 billion cubic meters by 2005. Within the same period, industrial usage increased from 0.032 billion cubic meters to 0.0477 billion cubic meters, while municipal water allocation increased from 0.095 billion cubic meters to 0.1431 billion cubic meters. Despite these trends, the historical data from 1992 to 2015 shows a decline in number of people with no access to safer drinking water, from 5,412,132 to 1,674,388 (Figure 4.7), a development which can be attributed to massive water abstraction points which have since been constructed across Malawi especially in rural communities (WHO and UNICEF 2021).



**Figure 4.5:** Renewable water resources per capita in Malawi (Worldometers 2018).

## Water withdrawal per sector

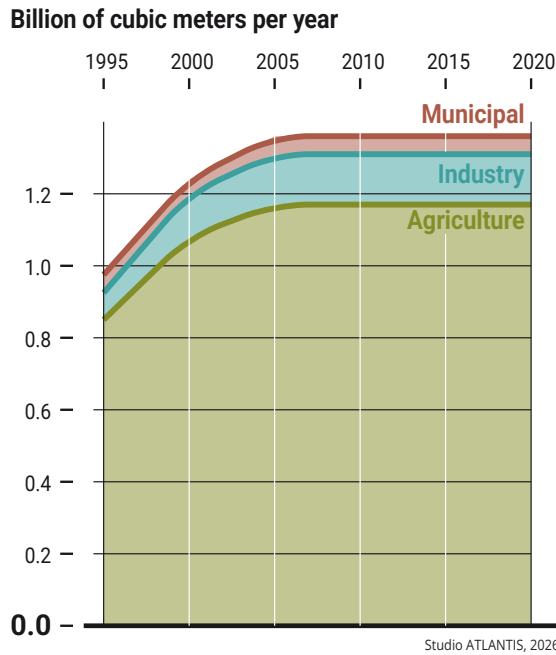


Figure 4.6: Water withdrawal per sector (Worldometers 2018)

## Total population with access to safe drinking-water

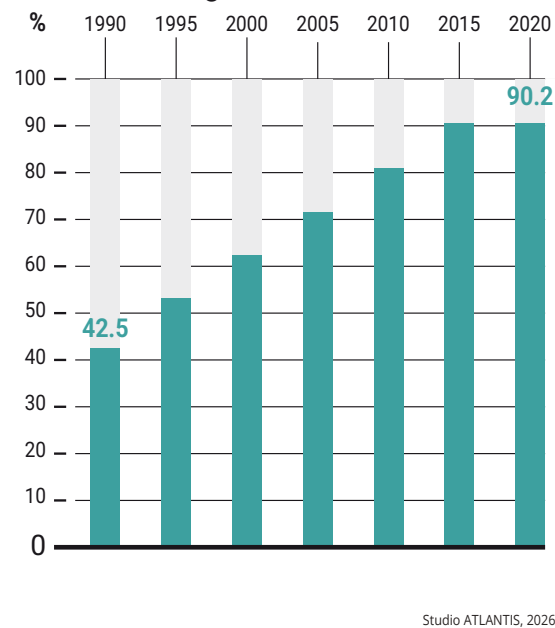


Figure 4.7: Historical data on Access to Safe drinking water (Worldometers 2018).

### 4.7 Extreme weather events: droughts and floods

Scientific predictions and evidence affirm that global climate change is likely to further increase exposure to multiple risks affecting the magnitude, frequency, and spatial distribution of hazardous and disastrous

events (IPCC 2014). Exacerbated by catchments degradation, the impact of increased runoff or reduced water availability cannot be overemphasised. Malawi, like many other Sub-Saharan African countries, suffers the multifaceted extremities of weather events such as droughts and floods.

### 4.7.1 Droughts

According to Global Disaster Dataset, the number of droughts from 1979 to 2016 in Malawi was 13 (Centre for Research on the Epidemiology of Disasters (CRED) 2025). During this period, drought affected a total population of 28.7 million in Malawi. Almost all droughts in Malawi are associated with El Niño. The whole country is vulnerable to droughts, although Karonga, Salima, Zomba, and Lower Shire are known to be more drought prone areas (World Bank 2010).

Droughts seriously disrupt water availability in quantity and quality, as well as agricultural productivity in Malawi due to increased evapotranspiration and reduced water flows into water bodies. Lake Chilwa dried up in 1995 due to drought (Government of Malawi 2006). In 2016, drought conditions resulted in extensive crop failures, affecting 2.8 million people across the country. Similarly, the 2023/2024 rainfall season was marked with an El Niño induced drought, which resulted in a 22.9 per cent decline in agricultural productivity against the five-year average (Bronstert *et al.* 2024).

### 4.7.2 Floods

In the face of climate change, flooding events in Malawi are on the rise. The spatial distribution of floods has also increased, partly fuelled by lack of natural barriers to overland flow of water, due to forest degradation as well as the modification of natural water channels through agriculture and sedimentation processes. During the period from 1967 to 2018, Malawi experienced 36 flooding events, affecting a total population of 2.85 million in both urban and rural areas. Other major flood disasters occurred in 1997, 2001, 2003, 2006, 2015, 2019, 2022, and 2023, involving the Shire, Ruo, Dwangwa, and both South and North Rukuru Rivers (Chairuca 2019).

These flooding events have caused massive damages to both human life and infrastructure, as well as the general environment, especially in districts of Chikwawa, Nsanje, Zomba, Phalombe, Mulanje, Dedza, Nkhatakota, Nkhatabay, Rumphu, and Karonga. In addition to the usual damage of crops and houses, the 1997 floods in Malawi also damaged the Bangula-Chiromo railway line in Nsanje District (Chairuca 2019). The 2023 floods caused by Tropical Cyclone Freddy killed 676 people, displaced more than 500,000 people, and caused extensive damage to roads, bridges, and homes. In 2024, other devastating floods were recorded in Kasungu and Nkhatakota Districts, as well as all of Lake Malawi's shore areas. As a result of the Dwangwa river swelling, more than 7,000 people were displaced from the Dwangwa Catchment (Bronstert *et al.* 2024).

Apart from major flooding events, flash floods are also recorded in urban and rural communities of Blantyre, Lilongwe, Kasungu, Salima and Karonga. Most of the urban floods are a result of informal settlements along

riverbanks that alter the natural waterways. Some of the very common areas where urban floods are prominent include Zolozolo and Chibavi areas in Mzuzu, Mtandire area in Lilongwe, and Machinjiri in Blantyre. In these areas, increased runoff destroys infrastructure almost yearly.

## 4.8 Ecosystem health

Malawi's freshwater ecosystems are fundamental to the national economy, providing fisheries, water supplies, hydropower, irrigation, and biodiversity services that sustain millions of livelihoods. Habitat loss, pollution, climate change, invasive species, and unsustainable exploitation increasingly threaten the integrity of these systems.

The decline in freshwater fish populations, especially in Lake Malawi, are symptomatic of broader ecosystem stress, which is largely due to overfishing, sedimentation, and degraded breeding habitats. The degradation of aquatic habitats reflects the breakdown of ecological processes critical to nutrient cycling, food web stability, and water purification. Additionally, urban runoff and agricultural intensification have increased nutrient and plastic loads into Lake Malawi, compounding eutrophication and raising concerns for both aquatic life and human communities.

Malawi's environmental management frameworks highlight the need for the adoption of integrated watershed and ecosystem-based approaches. Initiatives such as the National Fisheries and Aquaculture Policy and community-led wetland conservation programmes contribute to restoring ecological function and improving rural health outcomes.

### 4.8.1 Human health and ecological linkages

Human health in Malawi is intricately tied to freshwater ecosystem health. Over 60 per cent of total animal protein intake in the country is from fish, linking aquatic ecosystem integrity directly to nutrition security (Kalin *et al.* 2022). Polluted water sources from agricultural runoff and waste disposal elevate risks of waterborne diseases like cholera and typhoid, disproportionately affecting low-income urban and rural populations.

Sedimentation, poor sanitation, and weak waste management systems exacerbate vector-borne disease prevalence by altering aquatic habitats favourable to mosquitoes and snails that transmit malaria and schistosomiasis, respectively.

Wastewater generation is increasing in Malawi mostly due to rapid population growth, urbanisation, and industrialisation, which have resulted in treatment facilities failing to keep up with the demand. Most of the treatment facilities in Malawi are either old, non-functional, or their efficiency is greatly compromised due to numerous challenges. Inadequate wastewater management and

non-functional wastewater treatment facilities have severe environmental impacts, affecting public health, ecosystems, and economic development.

Msilimba and Wanda (2012) noted that in Malawi wastewater treatment works are only done in major cities of Blantyre (city) at Blantyre (district), Soche, and Limbe (smaller regions and neighbourhoods); Lilongwe (city) at Kauma (village); Zomba (city) at Chikanda (village), and Mzuzu (city) at Moyale. The practice of wastewater reuse is at a smaller scale and is mainly used for washing cars, irrigating pastures, cooling boilers, and watering lawns. The bulk of wastewater is disposed of directly into water bodies. Only 10 to 15 per cent of wastewater generated in the country is connected to sewage systems (World Bank 2021).

Even in cases where treatment is done, the efficiency levels are very low. Wastewater treatment plants in Blantyre and Lilongwe exhibit varying levels of efficiency in removing organic pollutants. The removal efficiency for Chemical Oxygen Demand (COD) ranges from 49 to 74 per cent. For Biochemical Oxygen Demand (BOD), primary treatment achieves removal efficiencies of 20 to 40 per cent, while trickling filters can remove up to 84 per cent. For Total Suspended Solids (TSS), primary treatment eliminates 40 to 60 per cent (Chipofya *et al.* 2010).

Environmental health in Malawi is directly linked to the condition of freshwater systems, land use patterns, and increasing anthropogenic pressures. The country's environmental health landscape reflects complex interactions between population growth, poor waste management, water pollution, air quality decline, and climate variability, all of which increase vulnerability to disease and reduce resilience across communities.

The World Health Organization (2025) Environmental Health Scorecard for Malawi ranked the country's overall health at 46/100, with particular weaknesses in water and sanitation services, exposure to household air pollution, and waste management capacity. Air pollution and waterborne diseases remain major public health challenges, with unsafe water, poor sanitation, and inadequate hygiene (WASH) estimated to contribute significantly to diarrheal diseases, cholera outbreaks, and malnutrition. Recurrent floods, droughts, and increased temperature fluctuations further heighten Malawi's vulnerability by amplifying risks of malaria, schistosomiasis, and vector-borne diseases.

Sanitation in Malawi remains a critical pillar of public health and environmental integrity. As of 2025, only about half of Malawians had access to basic sanitation, with rural areas underserved. In urban centres, informal settlements often lack improved toilets and proper faecal sludge management systems, making them

major risk zones during flooding events (World Health Organization 2025).

The ministry responsible for water affairs and partner organisations are implementing programs to promote Community-Led Total Sanitation (CLTS) and to expand urban faecal sludge treatment capacity. Initiatives such as decentralised waste treatment, composting toilets, and public-private partnerships in waste collection are being piloted in Blantyre and Mzuzu cities to improve urban sanitation efficiency. Additionally, international support through the National Sanitation and Hygiene Investment Plan and WASH in Health Care Facilities Initiative aims to provide safe, sustainable sanitation systems targeting schools, markets, and hospitals.

To achieve Sustainable Development Goal 6, it is estimated that Malawi needs US\$97 million to build and maintain universal basic coverage and an additional US\$258 million to build and maintain safely managed services each year up to 2030 (UNICEF 2023).

## 4.9 Transboundary water resources

Most of Malawi's surface water resources and much of its groundwater resources are shared with neighbouring countries. It is therefore important to recognise international water sharing agreements in resource use and planning. Lake Malawi and its catchment clearly show the magnitude of these shared water resources (Table 4.7) and importantly, the discharge from Lake Malawi through the Shire River is a major tributary to the Zambezi River, the basin of which is shared by eight countries and managed through the Zambezi Watercourse Commission (ZAMCOM). The Songwe River basin is shared with Tanzania and is central to bilateral cooperation efforts between Malawi and Tanzania through the Songwe River Basin Development Programme. The cooperation focuses on flood control, agriculture, and improved water supply, benefitting communities on both sides of the border.

The Lake Chilwa system is also shared with Mozambique. Inflows into Lake Chilwa originate from the eastern slopes of the Shire Highlands, the Zomba Plateau and the northern slopes of the Mulanje Massif. Jamu *et al.* (2012) and Rivett *et al.* (2020) indicate that, in the past, lake Chilwa used to dry naturally over a 15 to 20-year period. The lake has not completely dried out in the last 20 years. Another notable transboundary water resource is the Ruo river basin. Although just a tributary of the Shire River, the Ruo River, which partly borders Malawi and Mozambique, requires cooperation between the two countries to mitigate flood risks and support sustainable agriculture in surrounding areas. The groundwater resources also found within the named transboundary water resources are also managed as transboundary, with the Shire Basin transboundary aquifer being the largest.

**Table 4.7:** International contributions of run-off water to Lake Malawi

Variable	Malawi	Tanzania	Mozambique	Total
Catchment area of the lake (km <sup>2</sup> )	64,372	26,600	6,768	97,740
Flow (m <sup>3</sup> /s)	391	486	41	918
Percentage area (%)	65.9	27.2	6.9	100
Percentage flow (%)	42.6	52.9	4.5	100

**Source:** Ministry of Agriculture, Irrigation and Water Development 2016

#### 4.10 Indigenous and local knowledge for the management of water resources

Indigenous and Local Knowledge plays an important role in water resource management as it is based on principles of conservation, stewardship, and equity. Indigenous and local people have been managing their water resources for a long time, over which they have developed sustainable practices. Their knowledge is based on their relationship with nature, and they view water as a living entity and a habitat to their ancestral spirits. Traditionally, tree species such as *Faidherbia albida* (Winter Thorn; Msangu), *Syzygium cordatum* (Waterberry; Mkungu, Nyowe), *Trichilia emetica* (Mahogany), *Acacia xanthophloea* (Fever tree), *Rauvolfia caffra* (Quinine, Mwimbi), *Khaya anthotheca* (mmbawa), *Ficus sycomorus* (Fig, mkhuyu) and *Combretum* species have been used to stabilize river banks.

#### 4.11 Catchment management

Catchment management activities in Malawi involve the strategic planning and implementation of activities to manage the water resources within designated Water Resources Areas and Water Resources Units. Catchment management aims to balance water needs for agriculture, domestic use, and ecosystem health while addressing challenges like climate change, deforestation, and land degradation.

Although various catchment management activities are implemented by various stakeholders, their actions are guided by National Guidelines on Integrated Catchment Management and Rural Infrastructural (Government of Malawi 2015). Catchment management activities are strongly linked to national policy. For example, the Water Resources Act of 2013 provides for the management, conservation, use, and control of water resources, including the management of watersheds through Catchment Management Committees (CMCs). The Environmental Management Act of 2017 also aims to enhance environmental management and protection.

The Shire River Basin has been the focus of most basin planning and watershed management initiatives. This is mainly due to its size and importance for energy, water, and food security, and the basin's hot spot status for natural disasters, natural resources degradation, and soil erosion (Calow 2021). The Malawi Watershed Services Improvement Project (MWASIP) targets degraded watersheds in the Linthipe, Bua, and Dwangwa basins in the central region, and the North Rukuru and Lufilya basins in the north with a target of restoring 50 per cent of degraded landscapes in priority catchments.

Various international and local organisations promote food or cash-transfer programmes linked to watershed management interventions. For example, the Food for Asset (FFA) programme in Malawi has a core focus on watershed rehabilitation and management, targeting degraded catchments in eight southern districts of Chikwawa, Nsanje, Blantyre, Phalombe, Zomba, Machinga, Mangochi and Balaka. The districts are climate-vulnerable and chronically food-insecure.

Public works have been used since the mid-1990s for a variety of purposes. The Malawi Social Action Fund–MASAF (1998–2019) included a significant public works component implemented. Although not directly focusing on catchment management, the public works programme included tree planting, agriculture and irrigation activities which impacted and protected various catchments across the country. The Malawi National Social Support Programme offered a framework for different social protection initiatives that incorporates catchment management, with activities such as community forestry, tree nurseries, fishponds, climate-smart agriculture, and watershed management (Calow 2021). Watershed management has also been addressed through the Enhanced Public Works Pilot, focusing on smaller micro-catchments (typically less than 250 hectares, five per district) and includes forest restoration, gully reclamation, rehabilitation of water supply, and drainage.

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Photo: Glory Muva



# 05 Biodiversity

**Coordinating Lead Authors:** Emmanuel Vellemu, Tiwonge Mzumara-Gawa

**Lead Authors:** Kennedy Chifundo Adamson, Tamara Chirwa

**Contributing Authors:** W. Mgoola, P.Samson, M. Kapachika, G Muva, G. Malembo, J. Van der Wal, M Kalembe

**Fellow:** Mphatso Ganisyeje

## Executive summary

### **Malawi has unique biodiversity assets, but information is more available for the so-called charismatic species than others such as invertebrates and micro-organisms**

*(well established)*. The country is home to a variety of plants and animals that are found nowhere else in the world. Lake Malawi, with over 800 fish species, is one of the many ecosystem types that showcases this diversity. Invertebrates and microorganisms are still very poorly known and require much research investment. {5.0}

### **While sustainable land use and management are critical for food and water security, Malawi is witnessing an accelerated conversion of important ecosystems**

*(well established)*. Natural terrestrial ecosystems are largely found in protected areas, while those in non-protected areas are converted to agro-ecosystems. {5.2, 5.4.4}

### **Small-scale fisheries in the country's lakes are critical for livelihoods and the economy**

*(well established)*. These vital resources are increasingly threatened by overfishing and environmental degradation, making it difficult for the transition necessary towards sustainable, community-inclusive management strategies that are informed by both scientific and traditional knowledge. {5.2.3.1}

**Biodiversity underpins Malawi's economy and human well-being, but equitable access is weak** *(well established)*. From provisioning services like food and timber, regulatory services such as water purification and flood control, supporting services like pollination and

soil formation, to cultural services such as advancement of traditional beliefs and ecotourism, biodiversity is indispensable in the day to day lives of many Malawians. However, more work is required to strengthen ecosystem valuation, access, and benefit sharing, as well as equitable and sustainable utilisation of the country's biodiversity. Despite its importance, the value of the country's biodiversity is declining. This has been due to factors that include rapid population growth, leading to increased deforestation, biodiversity loss, and degradation of ecosystem services. For example, the number of globally threatened bird species in the country increased by 233 per cent since 2010. {5.1.1; 5.1.4; 5.2.2; 5.3, 5.4.2}

### **Knowledge and data gaps on biodiversity are limiting evidence-based policy action in Malawi**

*(well established)*. Whilst there has been much progress to understand the status and trends in biodiversity in Malawi, there is still more to be done. There is still work to be done on data collection on species that are important for agriculture, especially those that support soil health and livelihoods such as edible fungi. Strengthening biodiversity monitoring and scientific capacity is essential to guide evidence-based decision-making and to achieve Malawi's commitments under the Global Biodiversity Framework and Agenda 2063. Furthermore, Malawi Agenda 2063 (Pillar 3: Urbanization) stresses that urban centres will be well planned so as to promote efficient use of resources that create more sustainable land use and protect the biodiversity of natural ecosystems. {5.0, 5.2.3.2}



Communities are encouraged to collect rainwater for future use. Photo: Horst Vogel.

## 5.0 Introduction

Biodiversity refers to the variety of life on Earth at all levels, from genes to ecosystems and the ecological and cultural processes that sustain them (Mace *et al.* 2012; Center for Biodiversity & Conservation 2024). Malawi is home to biodiversity assets of both national and international importance, including over 17,000 recorded species that range from invertebrates to mammals. The country has recorded over 800 fish species, 122 plant species, 11 invertebrates, 2 mammals, and 1 bird species that are endemic to the country (Rawat and Agarwal 2015).

Biodiversity provides a life support system through global biogeochemical cycles and energy flows between organisms and food chains (Enuoh and Bisong 2014). Ecosystems holding endemic species and rich diversity, such as the rift valley and Lake Malawi, are currently facing multiple threats, including habitat loss and climate change. Biodiversity is intertwined with Malawi's economic, social, and cultural fabric (Government of Malawi 2015), forming a significant proportion of the wealth of the people, some of whom hold traditional beliefs and practices associated with forests, rivers, and mountains.

Biodiversity makes a direct and measurable contribution to national development. It supports key GDP-contributing sectors such as agriculture, fisheries, forestry, tourism, water and energy. Over 85 per cent of Malawians depend directly on natural resources and ecosystem services for their daily needs (Malawi Environmental Affairs Department 2015). Biodiversity holds a sacred role in food and nutrition security, water supply, biomass energy, cultural identity, and tourism revenues, making it central to achieving Malawi's Agenda 2063 aspirations, particularly target 7 on environmental sustainability. The Malawi 2063 (Pillar 3: Urbanization) stresses the fact that urban centres will be well planned so as to promote efficient use of resources that create more sustainable land use and protect the biodiversity of natural ecosystems.

Malawi's human population has been increasing, as shown by rises in density from 157 people/km<sup>2</sup> in 2010 and 230 people/km<sup>2</sup> in 2024, with the current population being 20.7 million. As a result, the deforestation rate has increased, particularly in protected areas, due to lack of reliable and affordable alternative sources of energy (Katumbi *et al.* 2015), leading to loss of ecosystem services for energy and food provisioning. The country's total forest areas declined from 2,661,700 hectares in 2010 to 2,241,700 hectares in 2020, while the number of globally threatened bird species recorded in Malawi increased by 233 per cent since 2010. Habitat loss and fragmentation, over-exploitation of biological resources, invasive alien species, and pollution remain major threats to biodiversity (Malawi Environmental Affairs Department, 2015).

Malawi ratified the Convention on Biological Diversity (CBD) in 1994, committing the country to conservation and sustainable use of biological diversity, and to fair and equitable sharing of benefits arising from the utilisation of genetic resources. The country has contributed to biodiversity conservation through the establishment and management of a network of protected and conserved areas (PCAs), including five national parks, four wildlife reserves, three nature sanctuaries, 87 forest reserves, and two Ramsar sites. In 2017, the Elephant Marsh became the second Ramsar site in Malawi, after Lake Chilwa, and was confirmed as a Key Biodiversity Area (KBA) in 2023 (Malawi Environmental Affairs Department 2015). The Environmental Affairs, Fisheries and Forestry departments in Malawi have championed the use of community conservation areas in efforts to ensure fair and equitable sharing of benefits.

## 5.1 The value of Malawi's biodiversity

Biodiversity found in ecosystems provides various goods and services that are crucial to human survival and livelihoods. The definition of ecosystem services as "the benefits people obtain from ecosystems" signifies the importance of biodiversity in the day-to-day livelihood options (Danley and Widmark 2016). These benefits are broadly categorized into provisioning, regulatory, supporting, and cultural services.

### 5.1.1 Provisioning services

Biodiversity and ecosystem services underpin key sectors contributing to GDP, including agriculture, fisheries, forestry, tourism, water, and energy. About 85 per cent of Malawians depend directly on these resources for their livelihoods. Over 80 per cent of agriculture is rainfed and heavily forest-dependent. The Government of Malawi reported that 11.2 per cent of non-farm enterprises engage in sales of forest-based products, with higher proportions in rural (13 per cent) than urban (6.2 per cent) areas. The forest supplies the majority of the country's energy which was valued at US\$ 352 million in 2017. This represents 5 per cent of national GDP and 12 per cent of natural capital. However, this contribution is threatened by rapid depletion; and current forest harvests exceed sustainable yield by 71 per cent (World Bank 2019).

Although few studies quantify biodiversity's value, several assessments highlight its economic and social importance. Makwinja (2022) found that 97.74 per cent of households around Lake Malombe depend on the lake for ecosystem services worth US\$124.36 million per year (1.97 per cent of GDP). Jamu *et al.* (2023) reported that community-managed fish sanctuaries increased fish species by 24 per cent around Lakes Malombe, Chiuta, Kazuni, and Malawi. Munthali *et al.* (2023) recorded a decline in ecosystem service values in Dedza from US\$88.7 million in 1991 to US\$76.8 million in 2015. These are projected to decline further to US\$76.0 million in 2035,

mainly due to anthropogenic pressures. Hall *et al.* (2019) found that areas with high forest cover had significantly improved vitamin A adequacy and dietary diversity.

### 5.1.2 Regulatory services

Malawi's natural capital, the main asset underlying its economic activity, is eroding due to widespread deforestation and land degradation. Forest loss increases soil erosion and vulnerability to floods and droughts, undermining food security. Approximately, one third of Malawi's land area is classified as forest. However, estimates suggest that 57 per cent of its forests were lost between 1972 and 1992, declining from 4.4 million to 1.9 million ha with an annual loss of 2.8 per cent (United Nations 2025). Malawi possesses diverse and valuable forests, but the country is losing them at an alarming rate. Forests, wetlands, savannas, and farmlands provide key regulating functions, including carbon sequestration, flood control, and water purification. Riparian zones and wetlands filter pollutants and maintain flow regulation, while forests and wetlands act as carbon sinks that influence rainfall and temperature patterns, and also help reduce sedimentation and flood risks. Additionally, these systems provide food for herbivores and other species that form the foundation of the food chain.

### 5.1.3 Supporting services

Supporting services maintain the functioning and productivity of ecosystems. Processes such as decomposition and mineral weathering sustain soil formation and fertility, essential for agriculture. Forests and wetlands cycle nutrients (nitrogen, phosphorus, carbon), supporting crop production, vegetation and forest

regeneration. In addition, various ecosystems in Malawi such as forests, wetlands, and grasslands provide habitats for a wide range of species, including the endemic fish in Lake Malawi and Lilian's lovebirds in Liwonde National Park (Mzumara-Gawa, Perrin and Downs 2014). Pollinators such as bees, butterflies, birds, and bats enable crop and wild plant reproduction, while animals disperse seeds vital for forest regeneration and ecosystem maintenance. Aquatic systems, especially Lake Malawi and its rivers, support fisheries through nutrient cycling, water regulation, and sediment control that sustain community livelihoods.

### 5.1.4 Cultural services

The term "biocultural" describes the dynamic, continually evolving and interconnected nature of people and place and the notion that social and biological dimensions are interrelated, recognizing that human and nature are one. This relationship makes all of biodiversity, which includes species, land and seascapes, and cultural links to the places where living things live. In Khulubvi Forest (Nsanje), many trees have traditional medicinal value, while community by-laws regulate the harvest of species such as *Jateorhiza palmata* ("thabalaba"), which is used to treat fever and rheumatism (Table 5.1) (Mzumara-Gawa, Perrin and Downs 2014).

Boasting protected areas (PAs) comprising five national parks, four wildlife reserves, three nature sanctuaries and 87 forest reserves covering almost 21 per cent of the country's total area; the importance of biodiversity and ecosystem services in supporting the well-being of poor rural communities cannot be overstated (Mzumara-Gawa, Perrin and Downs 2014). The importance of biodiversity also recognizes its intrinsic value irrespective of human needs and interests.

**Table 5.1:** Some plants found in national protected areas and their traditional use (Mzumara-Gawa, Perrin and Downs 2014)

Tree Species	Use
<i>Mkolantchentche</i>	For Epilepsy treatment.
<i>Pigeon pea leaves</i>	For safe delivery for a woman who engages with multiple sexual partners.
<i>Nyamukungu, Njenje, Mwanamphepo, Tangatasya</i>	Remedy for body swelling in children.
<i>Nthumbwa Kalulu</i>	Used as a contraceptive in women with multiple sexual partners.
<i>Muwawani</i>	Treats Malaria, cough, flu, and diarrhoea. Also used for abortion and contraceptive.
<i>Chizutu</i>	For stomach tumours
<i>Mvunguti</i>	Men genital enlargement
<i>Mtantha Nyerere</i>	Sexual stimulator

Tourism remains an important cultural service which is likely to bring much-needed foreign exchange to the country. Partnerships with conservation organizations such as African Parks in Majete Wildlife Reserve and Liwonde National Park, the International Fund for Animal Welfare (IFAW) in Kasungu National Park, and Peace Parks Foundation in Nyika National Park and Vwaza Marsh Wildlife Reserve have enhanced wildlife recovery, where tourism also has a corresponding increase. In Majete Wildlife Reserve in 2023, tourism revenue increased by 49 per cent, generating US\$759,087 (MK1.5 billion) for the park and making Majete the most economically successful protected area in Malawi. Investments in protected area management and ecotourism infrastructure, including a road network, a long-range wildlife communication system, and a predator-proof perimeter fence, have strengthened conservation and reduced human–wildlife conflict (African Parks 2020).

Malawi's ecosystems also hold deep cultural and spiritual significance. Sacred forests, graves, and natural landscapes form part of traditional practices and beliefs, underscoring the non-material value of biodiversity to local communities.

## 5.2 Ecosystems of Malawi

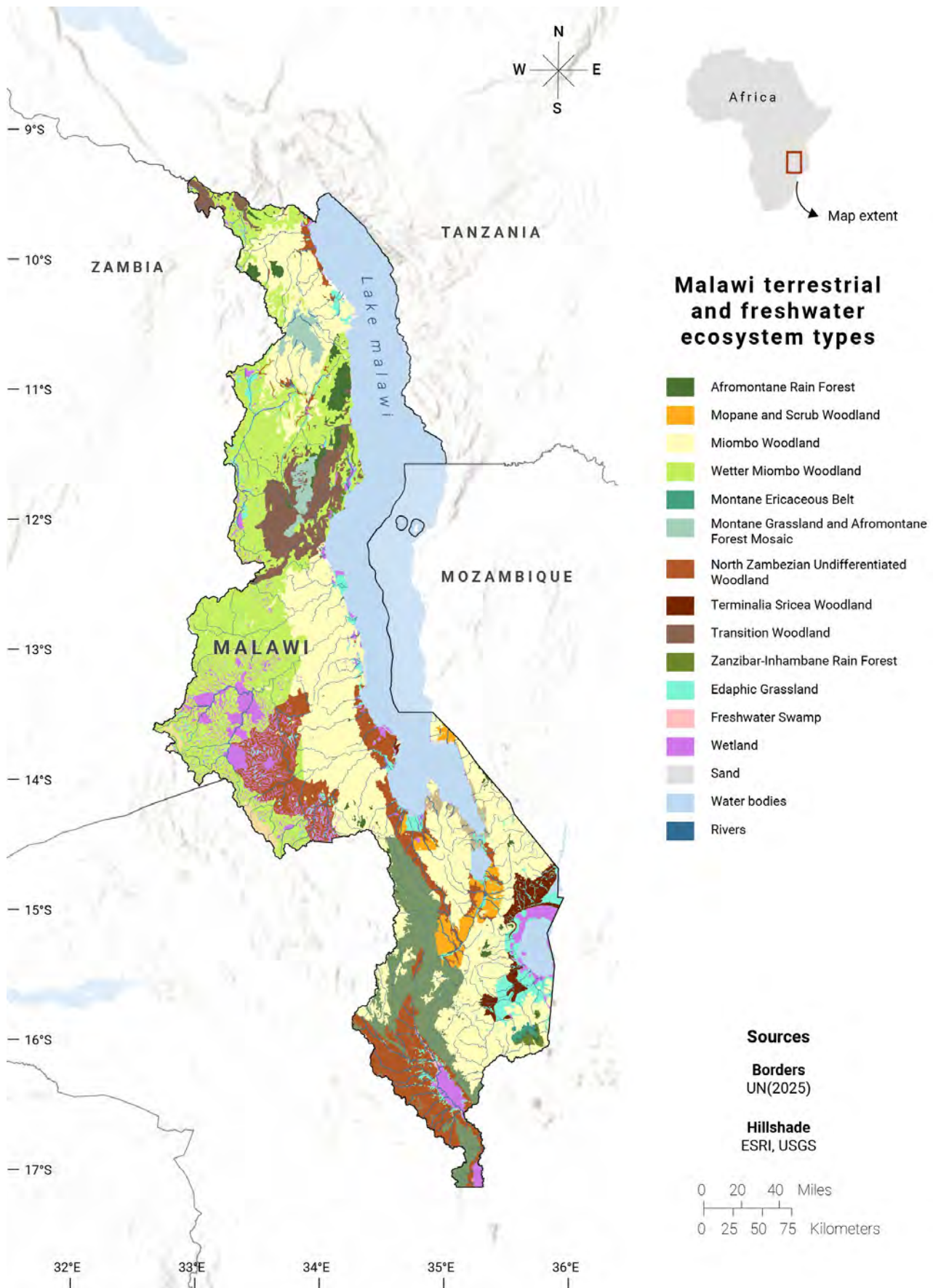
According to Convention on Biological Diversity, the major ecosystems in Malawi are terrestrial and aquatic, with the latter comprising close to 20 per cent of the total surface area. The greatest diversity of plants and animals exists in the country's 97 protected areas, 90 per cent of which are forest reserves (Convention on Biological Diversity n.d). Malawi's ecological richness is defined by its diverse biomes, including Afromontane forests, miombo woodlands, riparian wetlands, savanna grasslands, and the lacustrine ecosystems of Lake Malawi, a UNESCO

World Heritage Site and global biodiversity hotspot. The country's varied topography and climatic gradients support high species endemism, particularly in fish (e.g., more than 1,000 cichlid species) and flora (e.g., *Widdringtonia whytei*, the endangered Mulanje cedar). A critical advancement in ecosystem monitoring has been the development of Malawi's National Ecosystem Threat Status Map, with the inaugural 2018 assessment providing the first spatially explicit baseline of ecological degradation. The 2021 revision incorporated improved remote sensing data and anthropogenic pressure indicators, while the 2025 iteration aims to integrate climate vulnerability modelling, a progressive step towards evidence-based conservation. Anthropogenic drivers that include rapid deforestation, agricultural encroachment, and sediment loading in aquatic systems are degrading ecosystem integrity. In other words, terrestrial and aquatic ecosystems are being modified, degraded, and species composition altered due to the unsustainable utilization and management of natural resources. Protecting these systems is not merely a biodiversity imperative but a socio-economic necessity, as over 80 per cent of Malawi's population relies on ecosystem services for subsistence. Strengthening protected area networks, enforcing land-use policies, and promoting community-based restoration are urgent priorities to sustain Malawi's ecological resilience in the face of climate change. The main pressures on biodiversity consist of habitat loss and fragmentation, overexploitation of biodiversity, invasive alien species, pollution, and climate change.

Malawi produced its first ecosystem type map in 2018 as part of the Mapping Biodiversity Priorities Project by the Department of Environmental Affairs. This was revised in 2021 after stakeholder consultations. The ecosystem types for Malawi now stand at 67 types (Annex 4). These can broadly be grouped into about 16 types (Figure 5.1).



Forest fires impose economic, environmental and public health challenges in Malawi, especially during the dry season.  
Photo: Horst Vogel.



**Figure 5.1:** Ecosystem types for Malawi

## 5.2.1 Terrestrial ecosystems

### 5.2.1.1 Forests

A forest in Malawi is defined as land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 per cent, vegetated by woody trees, such as palms, shrubs, bamboos, saplings, and re-shoots (FAO 2015a). As of 2020, Malawi had 2,367,000 ha of forests, covering 21 per cent of total land area, of which 2,285,700 ha are natural forests and

82,000 ha are plantation forests. Forests in protected areas include five national parks, four wildlife reserves, three nature sanctuaries and 87 forest reserves. The 2018 National Forest Inventory identified 217 tree species in the sampled forests, with 114 recorded as rare with five or fewer specimens. Over 50 per cent of total biomass came from 14 species, with five miombo species (*Julbernardia globiflora*, *Uapaca kirkiana*, *Colophospermum mopane*, *Brachystegia bussei*, and *Brachystegia spiciformis*) contributing almost 25 per cent, reflecting typical miombo composition (Government of Malawi 2019).

### Species distribution in sample forests in Malawi

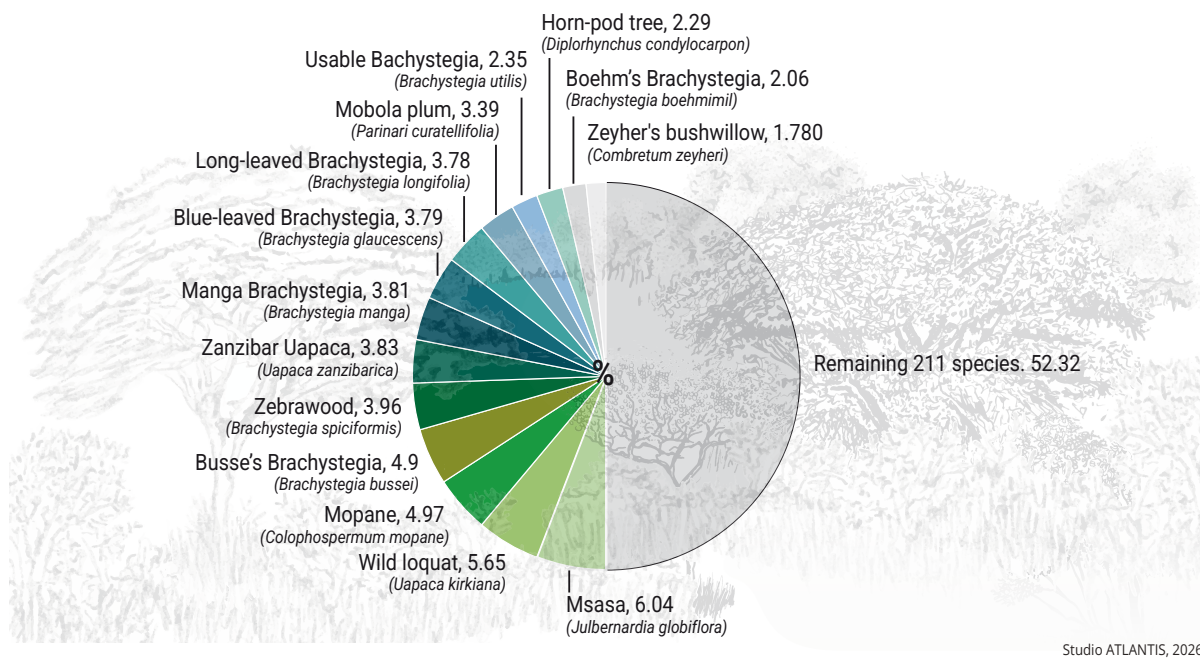


Figure 5.2: Species distribution in sample forests in Malawi (Government of Malawi 2019)

Between 2010 and 2023, Malawi lost 191,000 ha of tree cover (Global Forest Watch 2024). Loss was highest in the northern region, where Nkhata Bay (74,600 ha) and Mzimba (24,400 ha) together accounted for 52 per cent of national loss. Other districts with notable loss include Lilongwe with 9,760 ha, Mulanje with 9,190 ha, and Rumphu with 8,300 ha lost (Global Forest Watch 2024).

Deforestation is estimated at 33,000 ha per year, driven mainly by agricultural expansion, tobacco curing and heavy reliance on biomass for energy (Ngwira and Watanabe 2019). In Kasungu National Park, 21.12 per cent forest cover was lost between 1997 and 2018, with forest-to-shrub conversion dominating and forest regeneration remaining low (Kpienbaareh *et al.* 2022). Malawi's trends contrast with global patterns, where many countries report net forest gains (FRA 2020).

### Box 5.1: Urbanization. Loss of green spaces in cities.

With the rapid expansion of urban areas, urbanisation has emerged as a significant threat to biodiversity. According to the 2018 National Population and Housing census, 16 per cent of Malawi's population (about 2.8 million people) resides in urban areas of different sizes (National Statistics Office 2019). The country's annual urban population growth is estimated at 5 per cent, indicating a big shift towards urban living. Projections suggest that by 2050, 20 per cent of the country's population will be urbanised. This ongoing urbanisation trend poses a serious challenge to the country's biodiversity as it often leads to habitat destruction of such as urban forest reserves like Soche and Michiru; pollution; and the introduction of invasive species. The government has recognised the challenge through the Ministry of Lands and Housing, indicating a growing awareness of the need for sustainable urban planning (Manda 2013).

Urbanisation can be problematic primarily due to the environmental disturbances it causes, which increase pressure on biodiversity and urban green spaces. These green spaces are vital for biodiversity conservation, providing essential ecosystem services. The combined effects of rising urbanisation and population growth, along with inadequate regulatory frameworks, are accelerating loss of these ecosystem services. This decline affects ecological balance and reduces the overall quality of life (Muva 2024). For example, forest reserves like Michiru Mountain are experiencing severe degradation, with an estimated loss of over 1,904 hectares of forest cover. This loss has impacted local biodiversity, leading to the disappearance of species such as the Southern Ground-Hornbill and the Red-necked Falcon.

Several approaches have been put in place to address the challenge of biodiversity loss and urbanisation. The 2019 National Urban Development Policy is a commitment to fostering sustainable, competitive and resilient cities.

Afionis *et al.* (2020) argue that while urbanisation poses significant challenges to biodiversity conservation and ecosystem service provision, it also represents opportunities for enhancing urban resilience. Well designed cities should incorporate urban green spaces. Green spaces are positively correlated with enhanced biodiversity.

## 5.2.2 Aquatic ecosystems

Since 2010, Malawi has advanced its efforts towards protecting aquatic ecosystems and their biodiversity. Malawi's various aquatic ecosystems host a wide range of species. While the status of species is not fully known in each ecosystem, understanding the diversity, distribution, and abundance is important for their protection and management. Notably, there have been wide dynamics in species composition, abundance, and distribution due to ecosystem structure disturbances stemming from both anthropogenic and natural factors.

### 5.2.2.1 Lakes

Malawi's major lakes, namely Malawi, Chilwa, Malombe, and Kazuni, are critical freshwater ecosystems that support high biodiversity and sustain local livelihoods.

**Lake Malawi** is part of the Lake Malawi National Park, a UNESCO World Heritage Site. The lake is globally recognised as the world's most species-rich lake, particularly for its extraordinary cichlid diversity. Despite its ecological importance, the lake faces increasing pressure

from unsustainable fishing, targeting commercially valuable species. Studies show declining fish abundance and reduced sizes since 2010, which threatens both biodiversity and the protein supply for surrounding communities (Chalira 2024; Van Wyk 2019). The major current threats to Lake Malawi include overfishing and land use change with associated impacts on nearshore water quality.

**Lake Chilwa** hosts 14 documented fish species, with studies reporting no major changes in species diversity over the past decade (Njaya *et al.* 2011; Chavinda 2025). This stability highlights the importance of ongoing conservation efforts to maintain the ecosystem's balance. Lake Chilwa is seriously threatened by climate change.

**Lake Malombe** supports about 19 genera and 28 fish species across four families (Msiska *et al.* 2024). Despite this diversity, the lake has experienced declines in fish species over time, indicating the need for improved management. Like Lake Malawi, Lake Malombe is threatened by overfishing and land use change which has impacted its water quality.

**Lake Kazuni** is located within the Vwaza Marsh. Since the last National State of the Environment and Outlook Report in 2010, some positive developments have been documented, providing a foundation for future lake and catchment management strategies. Recent observations show that hippopotamuses dominate the lake, especially during the dry season, which affects habitat conditions for smaller mammals and aquatic organisms (Sungani *et al.* 2022). Several aquatic invertebrate families have been recorded, many of which are tolerant to pollution, while the limited presence of sensitive taxa may suggest water quality disturbances linked to hippopotamus activity. Continued monitoring is needed to better understand and protect this small but important lake ecosystem. Lake Kazuni is threatened by siltation due to stream bank cultivation and occasional fish diseases.

#### 5.2.2.2 Rivers and streams

Malawi's rivers and streams sustain various aquatic life, including endemic fish, invertebrates, and riparian vegetation, contributing significantly to the nation's biodiversity. Since 2010, limited studies have highlighted the diversity of aquatic life in Malawi's rivers. It is a well-known fact that Malawian Rivers are facing a lot of challenges including siltation, pollution, overfishing, and impacts of climate change. Below is a general overview of some of the most important rivers in Malawi.

**Shire River** – The Shire River and its catchment support a wide range of species, including diverse fish, aquatic plants, hippos, crocodiles, microorganisms, and invertebrates. However, aquatic invasive alien species pose significant ecological challenges. According to published reports (Tweddle *et al.* 1979; Chimatiro 2004; MultiConsult 2018), the river harbours at least 47 fish species from 14 families. Of these, two are critically endangered, three are data deficient, while the rest are of least concern under the IUCN Red List (IUCN Red List Version 2023-1). While the status of aquatic invertebrates remains poorly known, data collection has improved through initiatives such as the Mpatamanga Hydropower Project and the Shire Valley Transformation Programme.

**Ruo River** – Besides diverse fish species, the Ruo River supports a wide range of macroinvertebrates, with upstream sections showing the highest taxa richness (675 individuals) compared to midstream (200) and downstream (197) (Matemba 2024). Sensitive taxa like Ephemeroptera and Trichoptera thrive upstream, indicating better ecological integrity, while Diptera is the most abundant order across all sections. Midstream biodiversity in Ruo River appears to decline due to sedimentation and nutrient runoff, largely driven by human activities such as those associated with tea estates (Matemba 2024). These impacts alter water quality and habitat structure, making it difficult for sensitive aquatic species to survive. Protecting upstream headwaters and promoting sustainable land-use practices are essential for maintaining biodiversity. Regular biomonitoring of macroinvertebrates and integrating

physico-chemical assessments are considered effective for adaptive management, ensuring the conservation of the Ruo River and the Mulanje Mountain Forest Reserve's ecological balance.

#### 5.2.2.3 Wetlands and marshes

Wetlands and marshes provide very important ecosystem services in Malawi. They act as habitats to many animal and plant species, are used for agricultural purposes, and are also fishing grounds for a variety of aquatic species. This section discussed two of the most important examples of wetlands and marshes in Malawi.

**Elephant Marsh** - Elephant Marsh, a Ramsar site, is a mosaic of rooted swamp vegetation, floating flora, and open water with grassy margins and reed beds, interspersed with islands containing reeds, shrubs, and palm trees. Within the Lower Shire Basin, the Elephant Marsh plays important biodiversity roles while maintaining the valley's hydrological regime, through flood control, water storage, and supplying nutrient-rich sediment to surrounding communities. The Elephant Marsh is part of the flood plain of the Shire River. The marsh covers between 400 to 1,200 km<sup>2</sup>, depending on the extent of flooding and use of different wetland categories. At its northern margins it is a "semi-permanent" marshland, inundated during high water flows only, while to the south it becomes a small lake with islands, supporting floating mats of vegetation. Hippos, crocodiles and impressive flocks of large waterbirds thrive in this important marsh. According to Key Biodiversity Areas (2026), the main overall threat to the Elephant Marsh is the growing human population, not only directly surrounding the marsh but within its catchment. This population pressure has resulted in increased sediment input and biodiversity loss. The human encroachment into the Marsh has led to access to previously inaccessible areas, resulting in increased human-wildlife conflicts and habitat loss for birds as well as mammal species. The frequency of fires during dry periods in the marsh increase with burgeoning numbers of people cultivating in the Marsh. Other threats include poaching and illegal harvesting of fish, reptiles, mammals, and birds; invasive species such as water hyacinth (*Eichornnia crassipes*), water lettuce (*Pistia stratiotes*), and water fern (*Azolla filliculoides*); the incidence of human disease and wildlife interactions; climate change; and pollution from household wastes, or sewage. The large commercial sugar-cane estates on the edge of the marsh also impact the wetland through habitat modification on its edge, water extraction for irrigation, erosion, and potentially the runoff of agro-chemicals (pesticides, herbicides and fertilizers) into the wetland, raising the possibility of contamination and eutrophication from these sources.

**Lake Chilwa Wetland Biosphere Reserve** – According to UNESCO (2006), Lake Chilwa Wetland Biosphere Reserve is home to one of the world's most diverse populations of bird species. In 1997, the wetlands of the Biosphere

Reserve were designated a Ramsar site due to their global significance as a major waterfowl habitat. The Lake Chilwa Wetland Biosphere Reserve lies within the tropical dry or deciduous forest biogeographical region. Different land cover types are distributed throughout the reserve, including marshes, swamps, open lakes, five major rivers, islands, cultivated floodplains, and grasslands. Lake Chilwa is a tropical, closed lake. Under usual circumstances, one-third of the lake consists of open water, one-third of marshes, and one-third of floodplains. Within the last century the lake has dried and filled up eight times. Forests within and surrounding the reserve are some of the oldest in all of Malawi. Typha swamps cover wetland areas and serve as habitats and food providers for numerous species; they are equally important for nutrient cycling. Seasonal burnings of vegetation for hunting purposes endanger many particularly vulnerable species. Examples of common fauna species that live in the reserve are *Pelecanus rufescens* (Pink-backed pelican), *Python sebae* (Python), and *Alestes imberi* (Spot-Tail Tetra). *Zonocerus elegans* (Elegant grasshoppers) and *Pelomys fallax* (Creek rats) are also common species. The Lake Chilwa Wetland Biosphere Reserve is also rich in bird species, with 164 species living within the reserve and 41 Palearctic and 14 intra-African migrant species seasonally inhabiting the area. The Lake Chilwa Wetland Biosphere Reserve faces high population pressures, with 77,000 people living in the transition zone and 916,447 in the entire Lake Chilwa basin (Key Biodiversity Areas 2026). This is in addition to other factors like climate change and overfishing which have been outlined earlier.

### 5.2.3 Agro-ecosystems

#### 5.2.3.1 Fisheries and aquaculture

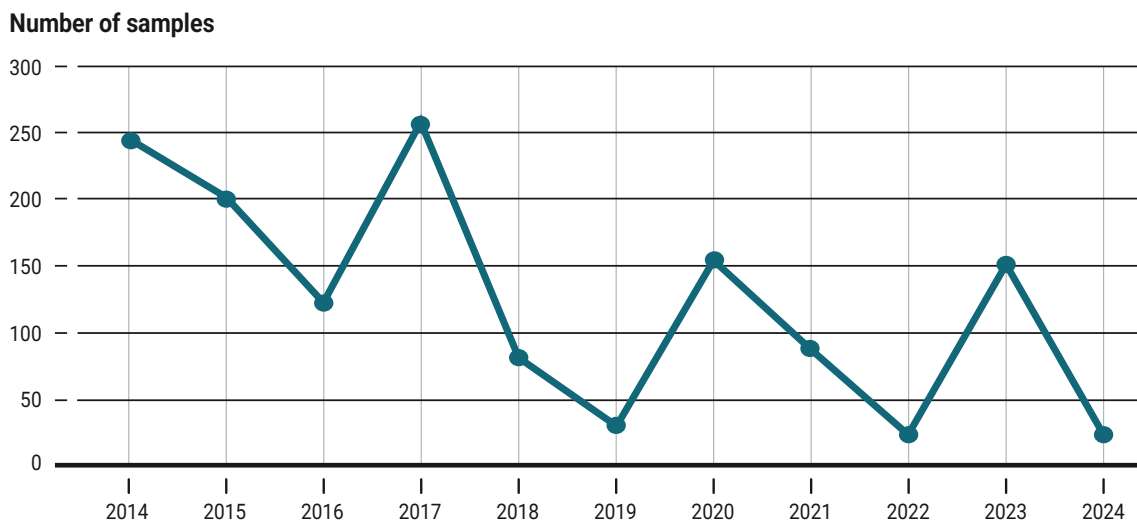
The capture fisheries of Malawi play a crucial role in food security, employment, and the national economy (Hara *et al.* 2015; Matiya and Wakabayashi 2005). However, these fisheries face significant challenges, including overfishing, declining catch rates, and depletion of valuable species (Weyl *et al.* 2010). For instance, in Lake Malawi, cichlid fish biodiversity is threatened by overfishing and habitat degradation, with recommendations for expanded conservation areas (Reinthal 1993). Management approaches have evolved from centralized control to co-management and community-based initiatives, with varying degrees of success (Hara *et al.* 2015; Matiya and Wakabayashi 2005). Factors contributing to management failures include poverty, increased fishing effort, and environmental threats such as nutrient inputs and sediment loading (Weyl *et al.* 2010). To address these

issues, researchers suggest transitioning from open-access to limited-access systems and incorporating indigenous knowledge into management strategies (Weyl *et al.* 2010; Donda and Manyungwa-Pasani 2018). Sustainable fisheries management in Malawi requires a comprehensive approach that considers both scientific and traditional knowledge while addressing the underlying socio-economic challenges faced by fishing communities.

#### 5.2.3.2 Agroforestry

Through various programmes championed by the Malawi government and its partners, agroforestry is encouraged. Agroforestry is one of the sustainable land management practices used to mitigate land degradation, which is affecting smallholder farmers in Malawi. Decline in soil fertility due to land degradation is leading to food insecurity. The government of Malawi, through the Department of Land Resource Conservation, is promoting use of agroforestry to improve soil fertility and for other benefits which are acquired through this technology (Gello and Juliusdottir 2021). Agroforestry is a system that manages the natural resources biologically by incorporating soil fertility-enhancing trees on farmland to sustain production and increase environmental benefits for land users (FAO 2015b). Apart from increasing soil nutrients and improving soil structure, agroforestry trees are also a source of firewood and fodder for livestock (Ajayi *et al.* 2007). More than 90 per cent of the documented agroforestry tree seed distributed to farmers is produced by smallholder farmers collected mainly from scattered farmland trees, the remainder being produced from seed orchards and seed stands owned or controlled by research organizations. Three organizations; namely the Land Resources Centre (LRC), National Tree Seed Centre (NTSC) of the Forestry Research Institute of Malawi (FRIM), and the World Agroforestry Centre (ICRAF); were identified as major procurers of agroforestry tree seed produced by smallholder farmers. Agroforestry germplasm is distributed to farmers by non-governmental organizations (NGOs) and government agricultural and forestry extension departments. The procurement and distribution of germplasm to farmers is in general effective. The major challenge to sustainability of agroforestry tree germplasm distribution in Malawi is dependence on donor funding (Nyoka *et al.* 2011). The Malawi Plant Genetic Resources Centre (MPGRC) is responsible for the collection, documentation, and preservation of Malawi's plant germplasm. Figure 5.3 shows the collection trend of germplasm by the Malawi Plant Genetic Resources Centre.

## Germplasm collection trends at MPGR



Studio ATLANTIS, 2026

Figure 5.3: Germplasm collection trends (MPGR)

## 5.3 Malawi's species diversity

### 5.3.1 Microorganisms

Microorganisms including archaea, bacteria, fungi, protists, and viruses are increasingly being identified due to advances in molecular technologies. To date, 12 Archaea genera and 69 bacterial taxa have been recorded in Malawi, with 6 showing drug resistance. Malawi has also documented 20 fungi species and 35 protist taxa, including pathogenic and non-pathogenic forms. However, phytoplankton and zooplankton remain poorly studied (Ngochera and Bootsma 2018; Makwinja *et al.* 2021).

### 5.3.2 Plants

As of April 2025, a total of 2,187 plant species had been recorded across the country. These include aquatic plants that support freshwater ecosystems and a wide range of grasses, herbs, shrubs and trees that provide food, timber, fuel, and medicinal resources (Coutts *et al.* 2019). Chikowe *et al.* (2021) examined 306 plant species and found that 127 of them were used to manage at least one symptom related to COVID-19 or were traditionally used to treat viral infections. However, plant diversity is increasingly threatened by habitat loss from agricultural expansion, high demand for fuelwood, weak enforcement of environmental laws, and the spread of invasive species. Intensive farming alters plant community composition, while over-harvesting of medicinal plants raises conservation concerns. Species diversity in agricultural landscapes significantly influences the types and abundances of plant species found (Mponela *et al.* 2010). Invasive species, mostly introduced through plant trade, modify habitats, outcompete native vegetation, and can

harbour pathogens, further reducing native plant growth and diversity (Kacheche *et al.* 2021).

### 5.3.3 Invertebrates

Invertebrates form an important part of Malawi's biodiversity, despite being the least documented groups, with much of the available data focused on agricultural pests. Several groups of invertebrates, including insects, molluscs, and crustaceans, occur both in terrestrial and aquatic ecosystems. Interest in aquatic invertebrates has increased recently, mainly due to their importance in monitoring river health and water quality. The iNaturalist portal documents approximately 2,354 insect species in Malawi, but it does not distinguish between terrestrial and aquatic species, making it difficult to determine their distribution and status trend across the ecosystems. Mulanje Mountain Forest Reserve is among the most important habitats for invertebrates as outlined below.

#### 5.3.3.1 Macroinvertebrates of the Mulanje Mountain Forest Reserve

Several aquatic taxa have been documented within the Mulanje Mountain Forest Reserve. Surveys recorded 65 *Odonata* species, with only eight dominants on a high plateau. Sensitive taxa, including mayflies and stoneflies such as Baetidae, Heptageniidae, Perlidae, and Notonemouridae have been documented. The presence of *Psychodidae* (moth flies), associated with poor water quality, near Lichenya Hut could highlight pollution by hikers discharging waste into the stream. The diversity of aquatic macro-invertebrates shows an increase in the downstream of the Lichenya peak, with dominating pollution-sensitive taxa including

Trichoptera and Ephemeroptera groups. Pollution-tolerant groups including Planariidae and Chironomidae are also common in the lower reaches of the river. The river's condition underscores the need for improved waste management in highland areas to preserve its biodiversity and maintain ecological integrity amidst growing anthropogenic pressures.

#### 5.3.4 Fish

Fish biodiversity remains remarkably rich, diverse and unique in Malawi. There are more than 1,000 species unique to Lake Malawi, with most of them belonging to the colourful and diverse cichlid family. Encouragingly, Chambo stocks, an important commercial fish species in Lake Malawi, show signs of recovery with high biomass levels in 2023 compared to 2010. Hydroacoustic estimates

from 2023 placed total fish biomass at over 111,000 metric tonnes in Lake Malawi alone. Fish distribution and abundance are strongly influenced by environmental factors such as temperature, dissolved oxygen, pH, and chlorophyll concentration. Spatial variations and the presence of distinct fish clusters across the lake segments suggest the need for joint conservation and management strategies. Fish migration, particularly among species like Chambo, is also influenced by environmental gradients. Despite observed declines in shallow water fish biomass, the lake's overall ecological conditions remain within normal ranges, suggesting the effectiveness of the ongoing biodiversity conservation initiatives, such as locally owned fish protected areas and capacitation of local fisheries management authorities at district level and closed trawling seasons.



Malawi has remarkably rich and unique fish biodiversity. Photo: Helle Biseth.

#### 5.3.5 Reptiles and amphibians

The total number of herpetofauna (amphibians and reptiles) species in Malawi is currently estimated at between 240 and 270 species, comprising about 90 to 100 amphibians and 150 to 170 reptiles. This is considered a conservative figure, as there remain significant opportunities to discover new species, particularly in under-surveyed habitats across the country. Despite these efforts, there has been no systematic assessment of the status and trends of this taxonomic group in Malawi, highlighting an urgent need for further research, monitoring, and conservation action. The reptiles and amphibians of Malawi are threatened by climate change through temperature extremes, habitat loss, and poaching.

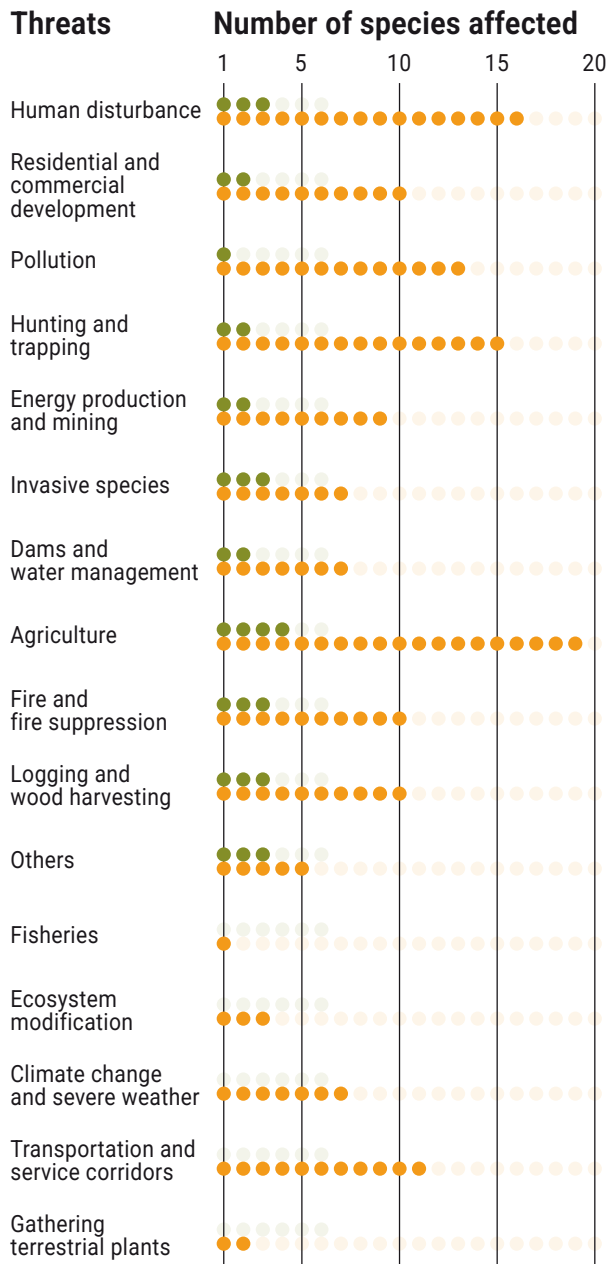
#### 5.3.6 Birds

Malawi has approximately 633 bird species (BirdLife Datazone 2024). Most of these birds, 94.3 per cent, are listed as Least Concerned on the IUCN Redlist of species (International Union for Conservation of Nature [IUCN 2024]). While 53.4 per cent of the population is stable, this alone does not guarantee their future. Only 8.7 per cent of the bird population is increasing, a figure that is significantly overshadowed by the 32 per cent that is steadily declining. In addition, the status of 5.2 per cent of the bird population remains unknown, adding to the uncertainty surrounding their conservation. Anthropogenic activities such as agriculture, hunting, logging, mining, residential, and commercial development were the main threats to the species. In 2024, the number of globally threatened species in the country increased from 6 to 20 (Birdlife Datazone 2024) (Figure 5.4)

## Main threats to birds

### Malawi's nationally threatened species

2011 6  
2024 20



Studio ATLANTIS, 2025

**Figure 5.4:** Main threats to globally threatened birds in Malawi, 2011 and 2024 (Birdlife Datazone 2024)

### 5.3.7 Mammals

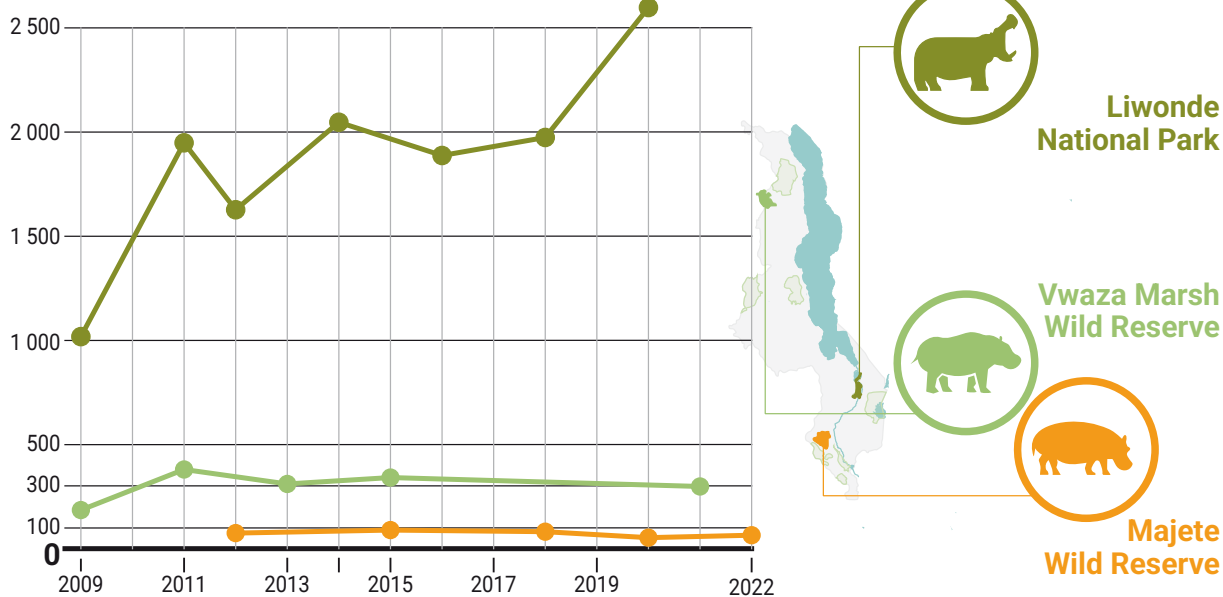
The population status of mammals in Malawi is unevenly documented, with aquatic species not as well-known as terrestrial species. Currently, hippos are the only aquatic mammal which has any systematic monitoring data (Figure 5.5). The Department of National Parks and Wildlife's Public-Private Partnership with the African Parks

Network in Majete Wildlife Reserve, Liwonde National Park, and Nkhotakota Wildlife Reserve led to improved conservation success. Majete supports over 12,000 large mammals and, since 2016, has translocated more than 1,100 animals to help restore wildlife in other protected areas such as Nkhotakota, Nyika, and Kasungu. The reserve holds nearly 3,000 translocated individuals from 17 species, including black rhino, elephant, lion, giraffe,

cheetah, and wild dog, while Liwonde has also recorded increasing wildlife populations under this management model. Despite these successes, there is still a need for

dedicated studies and monitoring of other mammals associated with aquatic systems, such as the African Clawless Otter and Marsh Mongoose.

### Hippopotamus counts



Studio ATLANTIS, 2026

Figure 5.5: Hippo counts in selected protected areas from 2009 to 2022 (Department of National Parks and Wildlife 2024).

#### Box 5.2: Recovery of vultures in Malawi

Vulture populations across Africa have experienced large declines due to habitat conversion, poisoning, loss of food resources and interaction with energy infrastructure (Botha *et al.* 2017). In Malawi, the extent of vulture declines is unknown due to lack of historical information. Four vulture species, including the White-backed Vulture (*Gyps africanus*), the Hooded Vulture (*Necrosyrtes monochus*), the Lappet-faced Vulture (*Torops trachelotus*) and the White-headed Vulture (*Trygoniceps occipitalis*) were reported as having disappeared from several protected areas. This disappearance was largely driven by deliberate poisoning by poachers and a decrease in food availability following the reduction in population of wildlife (Sievert *et al.* 2022). In 2018, Liwonde National Park reported a recurrence of these four vulture species following better law enforcement and the reintroduction of Cheetah (*Acynonyx jubatus*) and lion (*Panthera leo*) (Sievert *et al.* 2018). In 2022, Malawi documented its first sighting of the Egyptian vulture in Liwonde National Park. In 2021, there were reports of active White-backed nests observed in Liwonde National Park and Majete Wildlife Reserve.

## 5.4 Biodiversity issues

### 5.4.1 Data gaps

Conservation efforts in Malawi are held back by a lack of data on many threatened and endangered species. Data on biodiversity is mostly available for protected areas like National Parks, Game Reserves, and protected forests areas, but outside these areas there is very little information on biodiversity. Additionally, encroachment and poaching have threatened biodiversity in several areas to an extent that it is difficult to tell the exact number of

species; there is a need for frequent assessments which are not possible due to resource constraints.

### 5.4.2 Habitat loss and ecosystem degradation

Malawi's human population has increased by 55.01 per cent since 2008, reaching a population density of 214.38 people/km<sup>2</sup> in 2018 (Malawi, National Statistical Office 2018). As the population density increases, so do the threats to biodiversity (Tilman *et al.* 2017). Over-consumption of natural resources such as timber, fish, and charcoal, together with agricultural expansion, is

occurring at a rate that exceeds the environment’s capacity to regenerate. This results in habitat loss for many species and consequent biodiversity decline. Total forest area decreased from 2,661,700 ha in 2010 to 2,241,700 ha in 2020 (Figure 5.6), with deforestation rates particularly high in protected areas. Climate change has further intensified ecosystem degradation through unpredictable weather patterns, droughts, and floods. For example, the Shire River Basin continues to experience deforestation and siltation due to climate-induced pressures and unsustainable land use. Forest loss has reduced habitat availability for numerous species, leading to declines in biodiversity and associated ecosystem services, and poses a particular threat to habitat specialists that are unable to adapt to alternative ecosystem types (Mzumara *et al.* 2018; Dueker *et al.* 2023).

The rapid population growth and poor urban planning have simultaneously contributed to increased discharge of waste, including wastewater, plastic, and chemicals, degrading terrestrial and aquatic ecosystems (Kalina *et al.* 2020). Solid waste management is a major contributing factor to pollution. Only about 42 per cent of waste is properly collected, while the remainder is dumped on roadsides, rivers, or other illegal sites (Griffin *et al.* 2022). Chemicals from agricultural activities are washed into

nearby rivers through surface runoff, negatively impacting the survival of aquatic species such as the endangered mayfly *Adenophlebia auriculata*. By 2050, Malawi’s solid waste generation is projected to increase by 33 per cent, driven by population growth and increased reliance on single-use plastics (Turpie *et al.* 2019).

Productive ecosystems can have substantial ecological and economic value. However, eutrophication, fertilization beyond a natural productive state, can lead to negative impacts, particularly on species present in the affected habitat. In recent decades, eutrophication has developed into a major water quality problem in Malawi and is evident at different scales throughout the country in both rural and urban regions. Many communities are losing valuable aquatic resources, including multiple fish species that face polluted waters.

Sand mining and brick moulding have become prevalent practices across Malawi, both in urban and rural areas, exerting significant pressure on aquatic ecosystems. These activities often involve dredging riverbeds, disrupting ecosystem structures and ecological functions. The impact is further intensified by climate change, which brings irregular flow regimes and prolonged dry spells, exacerbating the challenges faced by aquatic biodiversity.

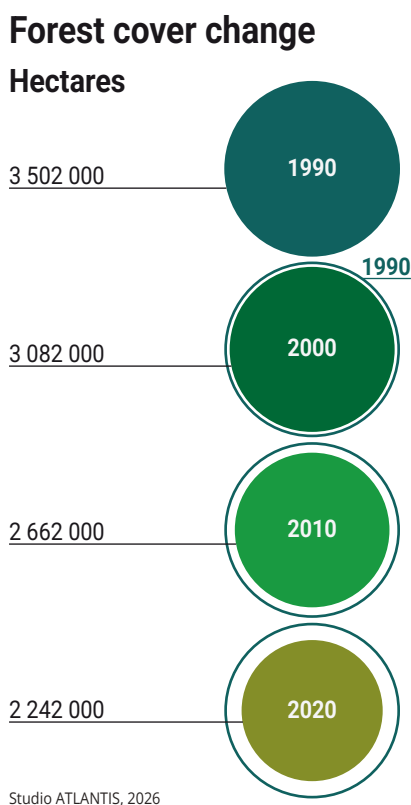


Figure 5.6: Forest cover change (FRA 2020).

### 5.4.3 Illegal offtake and trade

Illegal wildlife trade is one of the major threats to biodiversity loss in Malawi, with increasing cases involving endangered species such as pangolins. Prior to 2010, wildlife conservation mainly faced subsistence poaching, but by 2014, the Department of National Parks and Wildlife (DNPW) had identified illegal wildlife trade and poaching as serious concerns and commissioned an illegal wildlife trade review (2014–2015) to guide strategies against wildlife crime. In 2016, Malawi was identified as a country of primary concern and a key transit hub for trafficking. Despite illegal wildlife trade threatening species' survival, it also violates the National Parks and Wildlife Act of 1992. To address these issues, the act was amended in 2017 to impose tougher fines and penalties to reduce cases of wildlife trafficking and conserve endangered species (Schenning 2019). The loss of species due to illegal trade reduces genetic diversity, thereby weakening the ecosystem's resilience to environmental changes.

The illegal wildlife trade review found Malawi to be a major trafficking hub for ivory and other illegal wildlife products from both the nation and neighbouring countries. This was confirmed by the Elephant Trade Information System report submitted to the 17<sup>th</sup> meeting of the Conference of the Parties (COP 17) to the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which identified Malawi as a Party that serves as an entry point and exporter for illegal ivory in Southern Africa, classifying it as a "Country of Primary Concern." The report's findings formed the basis for most of the broad-based actions against trafficking currently implemented by the Department of National Parks and Wildlife and other agencies engaged in the fight against illegal wildlife trade.

Poaching and wildlife trafficking is still a challenge, although significant strides have been undertaken in the fight against wildlife crime in the country. Pangolin is the most trafficked wildlife species.

### 5.4.4 Human-wildlife conflict

Human-wildlife conflicts occur when human beings take negative actions on wildlife and vice versa (Gemed and Meles 2018). Such conflicts take the form of crop raiding, livestock depredation, and killing of people or animals. Known cases of human-wildlife conflict in Malawi are rare but occasionally reported in local newspapers. For example, on 6th January 2025, the Malawi News Agency reported that six elephants were killed in Kasungu National Park. A few months later, on 26th March, the Guardian Newspaper reported that at least 10 people had allegedly been killed by elephants ever since they were relocated to Kasungu National Park in July 2022. The increasing human population is affecting natural habitats, which continue to shrink, and natural resource conversion to agriculture continues to encroach the boundaries of protected areas. This results in human-wildlife conflict over living space, fuel wood, and

food. Human-wildlife conflicts in Malawi have become more frequent and severe since 2010 due to habitat loss, agricultural expansion, and human population growth, leading to increased incidents particularly involving elephants, hippos, and crocodiles (Nyirenda *et al.* 2011; Malawi, Department of National Parks and Wildlife 2018). Crop raiding by elephants and baboons near protected areas like Liwonde and Kasungu National Parks has caused economic losses, triggering retaliatory killings (Anthony and Wasambo 2009; Kyokuhaire *et al.* 2022). Crocodile attacks along the Shire River and elephant-related fatalities have further strained community and conservation relations (Malawi, Department of National Parks and Wildlife 2020; African Parks 2017). In response, mitigation strategies including chili fences, beehive barriers, and wildlife translocations (e.g., the 2016–2017 relocation of 500 elephants to Nkhota-kota by African Parks) have been successfully implemented (African Parks 2017). The construction of electric solar-powered game-proof fences around protected areas is being undertaken to minimize human-wildlife conflicts. However, inconsistent enforcement and limited funding continue to challenge long-term solutions (Kyokuhaire *et al.* 2022). While awareness and policies have improved, sustainable land use planning and stronger community engagement is important for reducing human-wildlife conflicts in Malawi.

### 5.4.5 Invasive and alien species

Invasive and alien species have emerged as a significant environmental and developmental threat in Malawi. These species are introduced, either intentionally or accidentally, outside their native habitats. They then often establish themselves and spread aggressively, disrupting ecosystems, economic activities, and public health. Malawi's vulnerability to invasive and alien species is heightened by its sub-tropical climate, dependence on agriculture, geographical location, and reliance on imports (Government of Malawi 2015). Since the 2010 National State of the Environment and Outlook Report, which first flagged invasive and alien species as a critical concern, Malawi has made notable strides in recognizing and addressing the issue.

Over the past decade, the number of confirmed invasive and alien species in Malawi has increased across various taxa. For plants alone, about 115 invasive and alien species have been documented. The aquatic plant *Eichornia crassipes* (water hyacinth), first reported in the 1960s, continues to pose severe ecological and economic threats, particularly in the Shire River system, by hindering fishing, irrigation, transportation, and hydropower generation. For example, water hyacinth invasions in 2003 and 2008 at the Liwonde Barrage caused a two-metre drop in water levels, disrupting energy production and water supply (Mellhorn 2013). Alongside *Pistia stratiotes* (water lettuce), these invasives deplete oxygen in water bodies, displace native plants, and create breeding grounds for disease vectors such as mosquitoes and bilharzia snails (Portilla 2020).

Invasive and alien species also threaten Malawi's terrestrial biodiversity and ecosystems. Invasive plants like *Mimosa diplotricha* reduce biodiversity by occupying grazing lands and affecting livelihoods. Forested and highland areas such as Mulanje Mountain have seen a sharp increase in invasive flora, rising from just seven recorded invasive and alien species in 1982 to over 30 species around 2020 (Witt *et al.* 2020). These include *Pinus patula* (Mexican pine), *Rubus ellipticus* (Himalayan raspberry), and *Pteridium aquilinum* (bracken fern). Although native, *P. aquilinum* behaves invasively, smothering native vegetation and raising fire risks. *Pinus patula*, originally introduced for timber, now competes with endemic species such as the endangered Mulanje Cedar. In response, the Mulanje Mountain Conservation Trust (MMCT) has led eradication efforts, engaging local communities in ecological restoration and alternative income-generating activities.

Protected areas across Malawi continue to experience ecological impacts from invasive and alien species. The Mulanje Mountain Forest Reserve, Nyika National Park, and Zomba-Malosa Forest Reserves are among those most affected, facing habitat alteration and loss of native species (Kacheche and Mzuza 2021). At least 17 plant

invasive and alien species have been identified in Nyika National Park alone. Species such as *Rubus niveus*, *Acacia mearnsii*, and *Pinus patula* dominate montane grasslands and wetlands, while *Lantana camara* is rapidly spreading across lower woodlands. Additionally, the introduction of *Oncorhynchus mykiss* (rainbow trout) for sport fishing poses potential threats to native aquatic biodiversity, though its full impact remains under-researched (Kacheche and Mzuza 2021).

In freshwater ecosystems, endemic species in Lake Malawi are at a particular risk from invasive and alien species. Invasive tilapiines like *Oreochromis niloticus* outcompete and hybridize with native fish species (Genner *et al.* 2013). The recently recorded gastropod *Melanoides tuberculata* is another concern, known to disrupt gastropod communities and potentially affect endemic species (Van Bocxlaer and Albrecht 2015). There is a pressing need for a comprehensive national strategy that integrates research, policy development, public awareness, and cross-sectoral collaboration. As invasive and alien species increasingly threaten biodiversity, livelihoods, agriculture, water resources, and public health, the urgency for coordinated, sustained, and holistic action is important.



Forest loss can result in alteration of their species composition. Photo: Sosten Chiotha.

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Photo: Helle Biseth



# 06 Air and climate

**Coordinating Lead Authors:** Babra Ntapara, Isaac Tchuwa  
**Lead Authors:** Keeness Mang'anda, Malazi Mkandawire  
**Chapter Fellow:** Latwifu Malemia

## Executive summary

**Air pollution is a growing environmental and public health concern in Malawi** (*well established*). Malawi's air pollution problem is largely driven by the use of biomass fuels, motor vehicle emissions, industrial activities, and waste burning. The annual mean concentrations of 24  $\mu\text{g}/\text{m}^3$  of fine particulate matter ( $\text{PM}_{2.5}$ ) surpass the recommended threshold of 10  $\mu\text{g}/\text{m}^3$  set by the World Health Organization. Urban areas such as Lilongwe and Blantyre are especially affected, creating health risks for the inhabitants {6.3}.

**Emission levels of key pollutants such as sulphur dioxide and nitrogen oxides are increasing causing a deterioration of Malawi's air quality** (*well established*). Industrial emissions of sulphur dioxide and nitrogen oxides increased from 200,000 tonnes in 2010 to 250,000 tonnes in 2023. Manufacturing and industrial activities are the major sources of the harmful gases. Emissions from vehicles have also increased from 120,000 tonnes in 2010 to 250,000 tonnes in 2023. Emissions from agricultural burning and waste disposal have increased from 120,000 tonnes in 2010 to 150,000 tonnes in 2023; emissions from mining operations have also gone up from 80,000 tonnes in 2015 to 100,000 tonnes in 2023. Residential emissions remain at about the same level of 70,000 tonnes between 2015 and 2023, linked to a heavy dependence on traditional fuels for cooking and heating purposes. Without adequate mitigation measures, emissions are expected to increase, posing a significant threat to air quality {6.3}.

**The health impacts of air pollution are felt most acutely by low-income residents in urban and rural areas, with poorly ventilated homes exacerbating the problem** (*established but incomplete*). Low-income communities in both urban and rural areas suffer from indoor air pollution due to the continued use of biomass for cooking and heating, and poorly ventilated dwellings, leading to high levels of exposure to  $\text{PM}_{2.5}$ ,  $\text{PM}_{10}$  and carbon monoxide. To address this issue, Malawi needs to invest in cleaner cooking technologies, improved ventilation in households, and shift towards the use of more sustainable energy sources. These efforts will not only improve indoor and outdoor air quality but also reduce the incidence of respiratory infections, cardiovascular diseases, and premature deaths, benefiting both urban and rural populations alike {6.3.3}.

**The air quality management framework in Malawi is guided by legislation and policies, but these lack comprehensive monitoring and enforcement** (*well established*). Key measures such as the Environment Management Act (EMA) (2017) and the National Environmental Policy provide a foundation for environmental protection and pollution control. The absence of detailed regulations for specific air pollutants constrains the effectiveness of air quality monitoring and enforcement {6.3.5}.

**Malawi's air quality monitoring network is limited to and concentrated in urban centres, which hampers a nationwide assessment of air quality** (*well established*). Monitoring stations are primarily located in Lilongwe and Blantyre, covering key pollutants such as particulate matter (PM), sulphur dioxide ( $\text{SO}_2$ ), and nitrogen dioxide ( $\text{NO}_2$ ). However, the limited geographic coverage of stations constrains comprehensive data collection, particularly in rural areas where activities like open burning and agriculture contribute significantly to air pollution {6.3.5}.

**Greenhouse gas emission sources are dominated by agriculture, followed by the energy and waste sectors** (*well established*). Agricultural activities remain the biggest contributor to the country's greenhouse gas emissions, particularly methane from livestock and nitrous oxide from agricultural soils. This pattern mirrors broader trends in developing countries, where the agricultural sector remains the dominant source of emissions. Emissions from energy and waste management sectors, particularly from fossil fuel consumption and methane from landfills, are also significant contributors. These patterns highlight the need for targeted mitigation strategies that address the main emission sources and consider sector-specific emission reductions. The country's climate action framework, including its Nationally Determined Contributions (NDCs) and other policies, aims to reduce emissions across these sectors while improving resilience to the impacts of climate change {6.3.2}.

**Malawi has experienced a steady rise in both maximum and minimum temperatures, signalling a warming climate with significant implications for agriculture, water resources, and human health** (*well established*). Temperature increase, evident in both hotter days and warmer nights, exacerbates drought conditions and heightens heat stress, crops, and livestock; threatening people's health, food, and water security. While the warming trend has been observed over the past decades, the most pronounced increases have occurred in recent years. Notably, regions such as the Shire Valley have seen more significant temperature shifts, with an increased frequency and intensity of heatwaves, further affecting livelihoods and agricultural productivity. These patterns align with global climate change projections, suggesting continued warming with lasting impacts on Malawi's climate, agriculture, and water systems {6.3.1, 6.3.3}.

**The frequency and intensity of extreme weather events in Malawi, especially floods, droughts, heatwaves and tropical cyclones, are on the rise, posing a growing threat to livelihoods and infrastructure** (*well established*). Heatwaves, tropical cyclones, and floods, have become more frequent and intense. Recent heatwaves, such as those recorded in 2019 and 2023, saw maximum day temperatures surpassing 40°C in some regions.

Tropical cyclones, including Cyclone Freddy in 2023, caused catastrophic flooding and significant loss of life, infrastructure, and economic resources. The growing frequency of these extreme events points to the increasing vulnerability of Malawi to climate-induced disasters. Such events also strain recovery efforts and highlight the urgent need for enhanced adaptive capacity and disaster management strategies. These trends are consistent with regional projections of climate change and reinforce the importance of preparing for more frequent and severe climatic extremes. The government's disaster response frameworks and adaptation plans are crucial in addressing these challenges, as they help minimize impacts on vulnerable populations and support recovery efforts {6.3.3}.

**Droughts, especially those affecting agricultural productivity, have become more frequent and severe, further exacerbating food security concerns** (*well established*). The recent drought conditions, such as those experienced in 2022 and 2023, have delayed the onset of rainfall and resulted in crop failures, with significant impacts on maize production, a staple food. These dry spells, compounded by pest infestations, are increasingly threatening the agricultural sector, which is crucial to the country's economy. This shift towards more severe and frequent droughts is consistent with broader climatic shifts observed in Southern Africa, and underscores the urgent need for climate-resilient agricultural practices and water management strategies. Although droughts occur less frequently than floods, their slow onset and devastating impact make them particularly challenging to manage. Addressing these issues requires robust adaptation strategies and climate-resilient infrastructure {6.3.3}.



The frequency and intensity of droughts is increasing in Malawi. Photo: Matthews Malata.

## 6.0 Introduction

Air quality in Malawi is generally good. However, it is slowly becoming a pressing environmental and public health concern due to significant pollution from use of biomass fuels, sawmill operations, cement manufacturing, vehicle emissions, and waste incineration. Additionally, deforestation has worsened air pollution, with dust storms becoming increasingly common across the country. As a result, emission levels of particulate matter (PM<sub>2.5</sub> and PM<sub>10</sub>), carbon monoxide, nitrogen dioxide, and ozone are increasing.

The country's population density, which increased from 157 persons/km<sup>2</sup> in 2010 to 230 persons/km<sup>2</sup> in 2024 (Government of Malawi 2024), triggered widespread land conversion, forest loss, and heightened reliance on biomass energy. As forests are cleared for agriculture and energy needs, both particulate matter pollution and carbon emissions intensify, compounding atmospheric degradation and diminishing the nation's natural carbon sinks.

Moreover, Malawi's energy landscape, characterized by a 96 per cent dependence on biomass fuels for cooking (Government of Malawi 2023a), directly translates into severe pressures on air quality and accelerates greenhouse gas (GHG) emissions. Household air pollution from cooking with wood and charcoal remains the country's most pervasive environmental health risk, driving elevated concentrations of particulate matter (PM<sub>2.5</sub>) far above World Health Organization (WHO) guidelines (WHO 2021).

Unsustainable agricultural practices, land degradation, and forest clearance are primary contributors to greenhouse gas emissions (Government of Malawi 2015). While Malawi's per capita emissions remain among the world's lowest, the projected 38 per cent rise in national greenhouse gas emissions by 2040 underscores the intensifying pressure on the atmospheric system (World Bank 2019).

The cumulative pressures on Malawi's air quality directly affect the country's climate system, exacerbating the frequency, severity, and spatial extent of extreme weather events, including floods, droughts, cyclones, and heatwaves. Malawi's geographic and climatic context makes it particularly vulnerable to the compounded impacts of these pressures, with observed increases in climate variability, rainfall unpredictability, and temperature extremes.

Malawi's climate is sub-tropical, characterized by a single rainy season from November to April, which accounts for about 95 per cent of the country's annual precipitation. Rainfall varies significantly across the country, ranging from 700 mm in the southern regions to 2,500 mm in the north, with cities like Blantyre, Lilongwe, Mzuzu, and

Zomba receiving average annual rainfall of between 900 mm and 1,433 mm (Government of Malawi 2023a). The warm-wet season is essential for agriculture, but irregular rainfall patterns and delayed rainy seasons have become increasingly common. The winter season, from May to August, is dry, with temperatures between 17°C and 27°C, though minimum nighttime temperatures can fall to between 4°C and 10°C, especially in higher elevations. The hot, dry period from September to October sees daily temperatures rising above 25°C.

Malawi's varied topography results in greater vulnerability to climate extremes. Low-lying regions like the Lower Shire Valley, Salima, and Karonga are prone to flooding, while higher-altitude areas experience cooler temperatures. Extreme weather events, including droughts (2019, 2022) and cyclones (Funso in 2012, Idai in 2019, Ana and Gombe in 2022, Freddy in 2023, Chido in 2024, Jude in 2025), have intensified, exacerbating the country's vulnerability to food insecurity, water scarcity, and socio-economic challenges.

## 6.1 Air quality

Air pollution continues to be a major challenge around the world, with the WHO (2022) stating that 99 per cent of the global population breathes air that surpasses guideline limits. In 2021, it was estimated that air pollution caused 6.7 million premature deaths worldwide, making it one of the top risk factors for mortality (Health Effects Institute 2022).

The United Nations Environment Programme (UNEP 2022) reports that numerous urban areas in sub-Saharan Africa face dangerously high levels of air pollution. For example, cities like Lagos have recorded PM<sub>2.5</sub> concentrations that are over four times higher than the World Health Organization's recommended safe levels. Lelieveld *et al.* (2020) found that air pollution accounts for an estimated 1.2 million premature deaths each year in Africa, driven by urban growth, dependence on solid fuels for cooking, and poor waste management practices. Only 10 to 15 per cent of urban wastewater is collected through formal sewerage systems, leaving the rest to be discharged untreated, often into water sources or open areas. Similarly, an estimated 70 per cent of municipal solid waste (MSW) does not undergo official disposal, leading to widespread illegal dumping and accumulation in public spaces. This underscores the urgent need for effective waste and air quality management strategies across the continent (World Bank 2019).

Malawi experiences moderate air quality issues, with an annual mean PM<sub>2.5</sub> concentration of 24 µg/m<sup>3</sup>, which surpasses the World Health Organization's recommended limit of 10 µg/m<sup>3</sup> (WHO 2023). While Malawi's air quality is fair, it still presents health risks, especially in urban centres like Lilongwe and Blantyre (Environmental Protection Agency 2023; Thulu *et al.* 2024; Utsale *et al.* 2025).

### 6.1.1 Sources of air pollution in Malawi

As Malawi grapples with increasing air pollution, understanding the status and trends of emissions from

various sources is essential for effective policy-making and public health strategies. Figure 6.1 shows increasing emission trends from industrial activities, vehicular sources, mining, agriculture, and open burning.

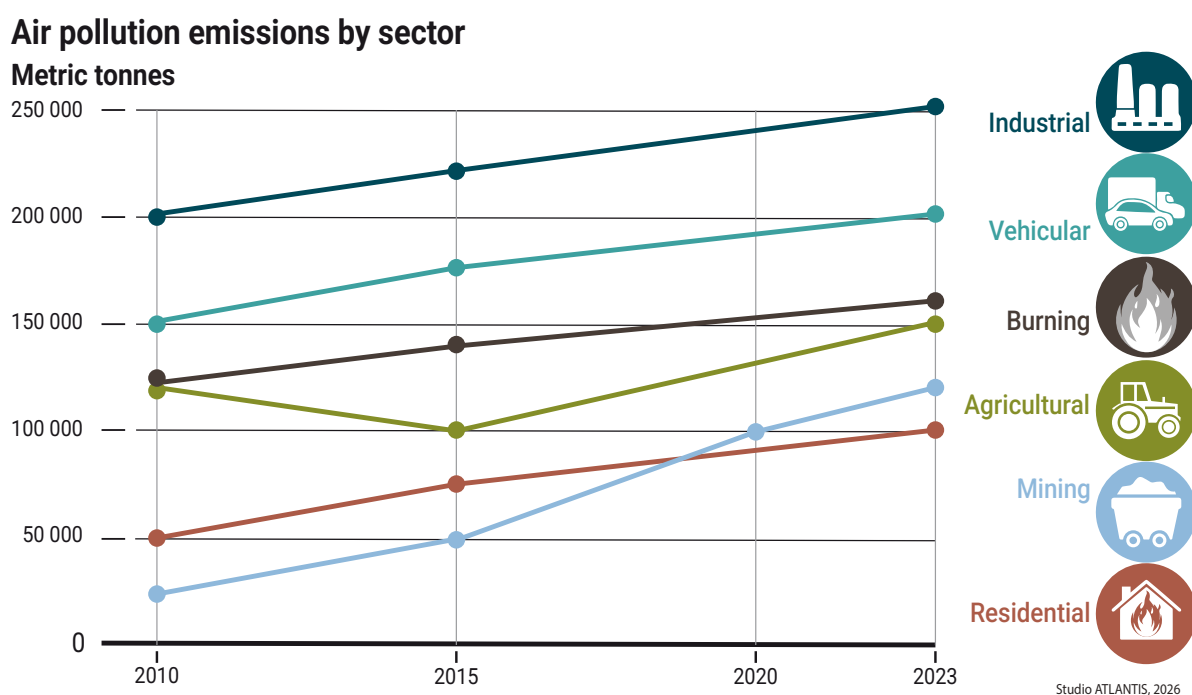


Figure 6.1: Status and trends of air pollution emissions in Malawi (2010-2023) (Source: UNFCCC 2015; Government of Malawi 2012; World Bank 2019; CEIC Data 2019; Emission Index 2024).

Emissions from industry have gradually increased from 200,000 tonnes in 2010 to 225,000 tonnes in 2015 and are estimated to have further increased to 250,000 tonnes by 2023. This rise is related to growth in industrial and economic activities (Government of Malawi 2012; UNFCCC 2015). Unless tighter emission controls are implemented, emissions of sulphur dioxide (SO<sub>2</sub>) and nitrogen oxides (NO<sub>2</sub>) are expected to increase rapidly, with annual increases of 10 per cent due to expansions in the manufacturing sectors (World Bank 2021).

Mining emissions increased from 80,000 tonnes in 2015 to an estimated 100,000 tonnes in 2023. This upward trend suggests a rise in mining activities, driven by the escalating global demand for minerals and resources

(Government of Malawi 2020). While mining can yield economic advantages, it also brings significant environmental challenges, including habitat destruction and air pollution. The growth in mining emissions underscores the urgent need for stricter regulations and practices that can mitigate environmental damage while maintaining economic sustainability.

Vehicular emissions show a more pronounced increase, rising from 120,000 tonnes in 2010 to 180,000 tonnes in 2015, and are expected to have reached 250,000 tonnes by 2020 (Figure 6.2). This notable surge reflects a rapid increase in vehicle ownership and usage (World Bank 2019), driven by factors such as urbanization, lifestyle changes, and inadequate public transport options.

## Vehicular emissions

Metric tonnes

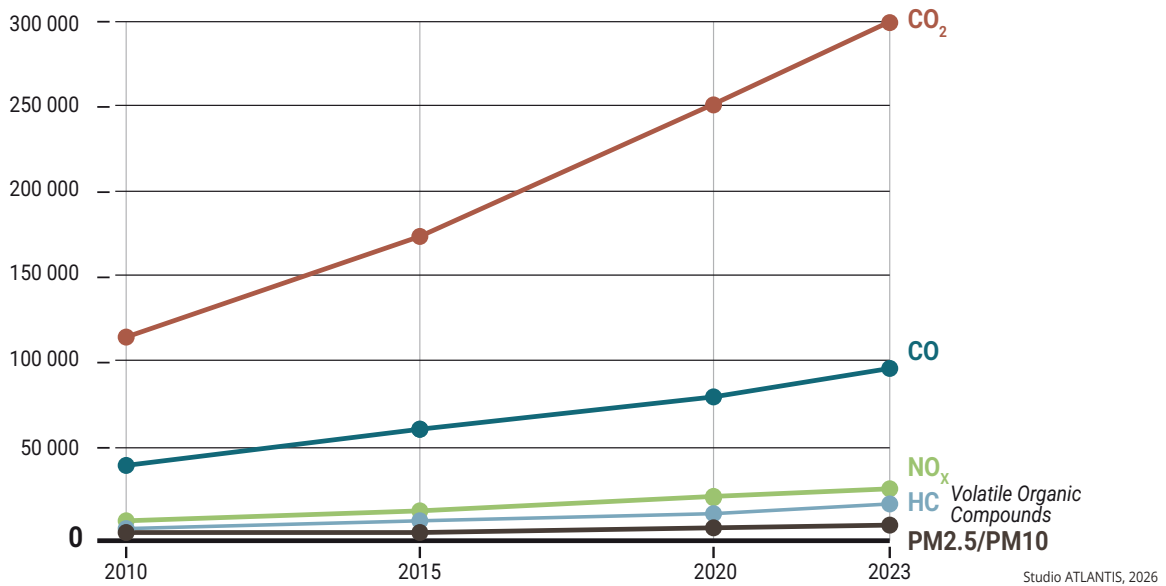


Figure 6.2: Vehicular emissions from 2010 to 2023 (Source: Government of Malawi 2012, 2023).

According to Malawi's national communications (NC3 2017), the transport sector was projected to have emitted 647.47 tonnes of carbon dioxide, 2.72 tonnes of methane, and 9.87 tonnes of nitrogen oxide by 2023. The aviation sector also contributed a significant amount of carbon dioxide and nitrous acid, around 29.88 tonnes and 0.26 tonnes, respectively. The increased trend of all significant pollutants raises serious concerns regarding urban air quality and public health, as elevated vehicular emissions can lead to respiratory diseases and other health complications. It highlights the pressing need for policies focused on reducing vehicular emissions, enhancing public transportation, and promoting cleaner energy alternatives.

Agricultural emissions have shown a steady increase, rising from 8.305 million tonnes in 2022, to 8.833 million tonnes in 2023.

This upward trend likely indicates more intensive agricultural practices, such as the increased use of chemical fertilizers and land clearing for crop production. While agriculture plays a crucial role in ensuring food security, the emissions associated with it highlight the

need for sustainable farming practices that can lessen environmental impacts. Techniques like agroforestry, crop rotation, and organic farming can help achieve a balance between agricultural productivity and environmental health.

Residential emissions have displayed a different trend, remaining steady at 70,000 tonnes in both 2015 and 2023 (World Bank 2019). This stability in residential emissions points to a lack of significant changes in household energy consumption habits. Many households still depend on traditional fuels, such as wood and charcoal, for cooking and heating, which significantly contributes to air pollution.

The emissions from burning practices, such as agricultural burning and waste disposal, have risen from 120,000 tonnes in 2010 to an estimated 150,000 tonnes by 2023 (World Bank 2019). This increase highlights ongoing challenges in waste management and the common practice of burning waste and crop residues. These emissions not only contribute to local air pollution but also have wider environmental consequences. Table 6.1 shows the key pollutants in Malawi, their concentration levels, as well as contributing factors.

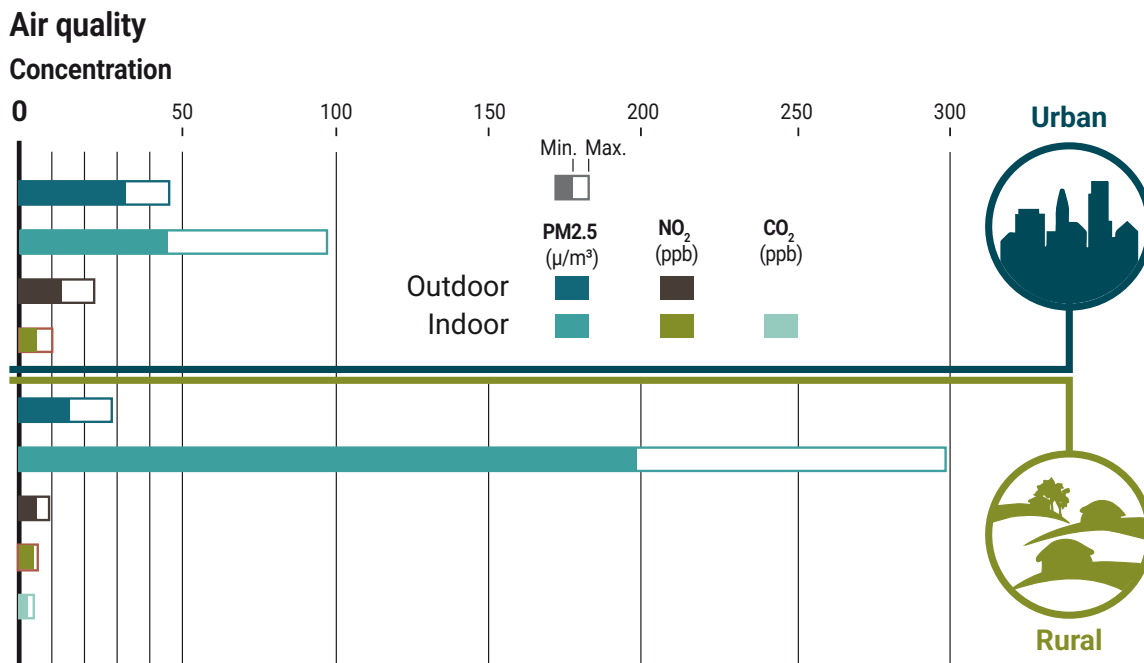
Table 6.1: Key air pollutants, common sources and their impact in Malawi (2010-2024)

Pollutant	Average Levels	Source/Contributing Factors	Health/Environmental Concerns
Particulate Matter (PM <sub>2.5</sub> /PM <sub>10</sub> )	>35 µg/m <sup>3</sup> (dry season)	Biomass burning, vehicular emissions, dust	Respiratory issues, cardiovascular diseases
Carbon Monoxide (CO)	Stabilized, seasonal peaks	Traffic, biomass cooking fuels	Respiratory and cardiovascular risks
Ozone (O <sub>3</sub> )	30-45 ppb (seasonal peaks)	Biomass burning, regional transport	Lung inflammation, reduced crop yields
Nitrogen oxides (NO <sub>2</sub> )	10-15 ppb (urban centres)	Traffic, industrial emissions	Respiratory issues, acid rain contributor
Sulphur Dioxide (SO <sub>2</sub> )	Low, occasional spikes	Industrial processes, equipment malfunctions	Acid rain, respiratory issues

### 6.1.2 Indoor and outdoor air pollution

The presence of particulate matter in both outdoor and indoor air presents a human health risk. There is significant difference in the concentration of ambient particulate matter in rural and urban areas (Jelili 2020). The most harmful air pollutants in urban areas are ground-level ozone (O<sub>3</sub>), fine particulate matter (e.g. PM<sub>2.5</sub>), and nitrogen dioxide (NO<sub>2</sub>), arising from vehicular emissions, industrial activity, domestic heating, and construction dust (Liang and Gong 2020). Between 2010 and 2024 (Figure 6.3), Malawi's cities, particularly Blantyre, Lilongwe, and Mzuzu, recorded outdoor PM<sub>2.5</sub> levels ranging from 35 to 50 µg m<sup>-3</sup>, consistently exceeding the World Health Organization limit of 10 µg m<sup>-3</sup> (WHO 2021). Average nitrogen dioxide concentrations reached 15 to 25 ppb, while carbon monoxide (CO) levels ranged between 1.5 and 2.5 ppm (EPA 2022). In Blantyre City PM<sub>2.5</sub> values were found to range between 2.5 to 27.7 µg m<sup>-3</sup> across industrial, commercial, and residential sites, reflecting the influence of localized anthropogenic activities (Saleh *et al.* 2022).

Rural areas generally showed better outdoor air quality, with particulate matter (PM<sub>2.5</sub>) concentrations ranging from 15 to 30 µg m<sup>-3</sup> (Ministry of Natural Resources and Climate Change 2024), yet indoor pollution remains a serious challenge due to the dominant use of biomass fuels for cooking and heating. Concentrations of PM<sub>2.5</sub> in rural households often exceed 200 µg m<sup>-3</sup>, while carbon monoxide levels reach 2–4 ppm (WHO 2021). These exposures disproportionately affect women and children who spend long hours near indoor fireplaces. In contrast, urban households that have adopted liquefied petroleum gas (LPG), improved stoves, and better ventilation report reduced indoor PM<sub>2.5</sub> levels of 50 to 100 µg m<sup>-3</sup> (EPA 2022). Mapoma *et al.* (2014) observed that urban carbon monoxide concentrations were within permissible limits, but nitrogen oxide (≈ 4 µg m<sup>-3</sup>) and SO<sub>2</sub> (≈ 8.6 µg m<sup>-3</sup>) levels exceeded national standards due to traffic density and industrial emissions.



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Figure 6.3: Air quality statistics in urban and rural Malawi (2010–2024) (WHO 2021).

Respiratory diseases remain the most pronounced health consequence of air pollution in Malawi. Acute respiratory infections (ARI) have ranked among the top causes of morbidity, particularly among children under age five. Between 2010 and 2023, outpatient cases of acute respiratory infections have increased significantly, from approximately 30 per cent to 40 per cent (Malawi Ministry of Health 2022). Similarly, admissions to hospital for complications of acute respiratory infections have increased, especially in urban centres of Lilongwe and Blantyre, where air quality has continued to deteriorate due to increased vehicular emissions and industrial activities. In rural areas, the continued reliance on firewood and charcoal for cooking exposes households to high levels of indoor air pollution. Women and children are most affected because they spend most of their time in the indoor, poorly ventilated spaces where biomass fuels are used (WHO 2021). The World Health Organization estimates that more than 10,000 premature deaths in Malawi per year are attributed to household and ambient air pollution caused by the use of solid fuels for heating and cooking (WHO 2023)

Cardiovascular diseases (CVD) due to air pollution also have become a critical concern. Conditions such as hypertension, stroke, and heart disease have shown a marked increase over the last decade, particularly among middle-aged and elderly populations. In 2010, it was estimated that approximately 10 per cent of cardiovascular diseases cases in Malawi were due to air pollution. In 2023, the percentage increased to approximately 15 per cent (Global Burden of Disease 2023). Stroke incidences alone increased by 20 per cent,

with urban populations being highly affected due to increased exposure to PM<sub>2.5</sub> from vehicle emissions and industrial activities (Malawi Environment Protection Authority 2023).

Air pollution has also contributed to high levels of childhood mortality, especially through pneumonia and other respiratory complications. While Malawi has made some progress in reducing mortality rates for children under five, the gains have been modest amidst persistent air quality challenges. In 2010, the under-five mortality rate from air pollution-related illnesses stood at 75 deaths per 1,000 live births. The 2023 figure stands at 60 deaths per 1,000 live births, a decline that indicates improvements in healthcare but contrasts with the continued health burden from polluted air in both rural and urban areas. The emerging health impacts, including pollution-linked cancers, are becoming more pronounced. Respiratory cancers, including lung cancer, have been increasing due to exposure to industrial pollutants and vehicular emissions from rapid urbanization. Information from the national cancer registry showed that lung cancer cases increased by 18 per cent between 2010 and 2023 (Malawi Cancer Registry 2023). This trend indicates the possible long-term health risk due to chronic exposure to injurious air pollutants among the general population with no previous smoking history.

The economic implications of air pollution in Malawi are substantial. The World Health Organization (2018) estimated the economic costs of air pollution in Malawi to be around 1.7 per cent of the country's GDP. Air pollution affects healthcare expenditure, the agricultural sector, and

general production loss. The healthcare costs associated with air pollution are particularly burdensome, as the treatment of pollution-related illnesses places a significant strain on the country's already overburdened healthcare system. The financial burden of air pollution on Malawi's health system has grown significantly. The Malawi Ministry of Health estimates that the treatment of pollution-related illnesses costs the healthcare system around MK 1.3 billion (approximately US\$ 1.8 million) per year (Malawi Ministry of Health 2022). In 2010 alone, diseases linked to air pollution accounted for roughly 8 per cent of hospital admissions nationwide. By 2023, this proportion had risen to nearly 12 per cent, placing immense pressure on the country's healthcare infrastructure (Malawi Ministry of Health 2022). Apart from economic losses from the health sector, air pollution also impacts efficiency, contributing to loss in productivity and impacting Malawi's overall economy. For instance, high absenteeism due to subsequent air pollution impacts the agricultural sector in particular, which is a significant contributor to Malawi's economy. A study by the International Food Policy Research Institute found that air pollution can reduce crop yields and affect farmers' incomes, leading to significant economic losses (Chakrabarti *et al.* 2020). Respiratory diseases like chronic obstructive pulmonary disease and acute lower respiratory infections pose a greater burden on more vulnerable populations, negatively impacting workforce productivity and consequently exacerbating Malawi's poverty levels. In addition, air pollution related diseases have proved to worsen educational and economic inequality whereby children from polluted environments tend to miss school because of illness, but it also affects their families economically due to the continued medical costs (Rylance *et al.* 2020).

Additionally, air pollution has an impact on the environment. The environmental impact of air pollution in Malawi is a significant concern due to industries' emissions, car exhaust fumes, land use change, smoke, and dust that are released into the atmosphere. Kumwenda *et al.* (2014) found out that the widespread air pollution found in rural areas is mainly due to bush fires and indoor burning of wood fuel. Most of the households in Malawi use firewood for cooking which produces pollutants that are released into the atmosphere. This overreliance on charcoal and wood fuel for energy contributes to widespread deforestation in Malawi. It is estimated that at least 33,000 ha of forest land is being lost annually (Ngwira and Watanabe 2019). Therefore, this loss of carbon sinks due to deforestation and increased particulate matter in the air due to forest fires and land clearing activities contributes to poor air quality. Furthermore, industrial activities such as mining and manufacturing release pollutants into the air, contaminating water bodies and affecting aquatic life. For instance, industrial effluent has affected the air quality of surrounding areas of the Linthipe River, affecting the livelihoods of local communities that depend on fishing and other aquatic resources (McCollough and Barber 2007). A combined effect of all these factors has an

impact on the environment which contributes to climate change, exacerbating droughts, floods, and other extreme weather events.

### 6.1.3 Air quality monitoring

Air quality monitoring in Malawi is guided by a developing legal and institutional framework of laws and regulations aimed at controlling air emissions, protecting human health, and environmental standards. The case for integrated air quality management is strong, in light of increasing emission levels of pollutants into the atmosphere due to urbanization, industrial activities, and population growth (World Bank 2019).

Malawi's framework for air quality is supported by acts, policies, and a network of agencies tasked with implementing, monitoring, and enforcing air quality standards. The Environment Management Act of 1996, which was updated in 2017, serves as the primary legislative backbone for overseeing environmental protection, including air quality regulations (Government of Malawi 1996). This legislation mandates the establishment of environmental quality standards for various pollutants and entrusts the government with the enforcement of these standards. In addition to the Environment Management Act, sector-specific policies such as the National Environmental Policy and the National Climate Change Management Policy emphasize pollution control and air quality monitoring as critical elements for sustainable development (Ministry of Natural Resources, Energy, and Mining 2016). The lack of detailed regulatory provisions specific to air pollutants within these frameworks limits comprehensive monitoring and enforcement efforts.

The institutional framework for air quality monitoring in Malawi primarily involves the Environmental Affairs Department, which works in conjunction with the Malawi Bureau of Standards, the Department of Environmental Health, and local governments. While these institutions are tasked with monitoring air quality, historical resource limitations have constrained the extent and reliability of data collection and analysis (World Bank 2021).

Malawi's network of air quality monitoring stations is still limited and concentrated in urban centres such as Lilongwe and Blantyre. These stations monitor key pollutants like particulate matter (PM), sulphur dioxide (SO<sub>2</sub>), and nitrogen dioxide (NO<sub>2</sub>), but their limited number and geographic coverage hinder a comprehensive nationwide assessment. This gap in monitoring limits data availability for rural areas where activities such as open burning, mining, and agriculture also contribute to air pollution.

To bridge these gaps, Malawi has taken steps to strengthen and expand its air quality monitoring infrastructure. Collaborations with international organizations, including the United Nations Environment

Programme (UNEP) and the World Health Organization (WHO), support pilot projects aimed at expanding monitoring stations and improving data collection technologies (WHO 2021). Advancements in low-cost sensor technologies present new possibilities for more extensive and cost-effective monitoring, even in remote regions. Currently, public universities (Malawi University of Business and Applied Sciences (MUBAS) and Mzuzu University (MZUNI)) have taken a leading role in the use of low-cost sensors to monitor air quality in some selected districts of Malawi. Through these initiatives, Malawi aims to build a more extensive network capable of providing real-time air quality data to inform policy development and enhance public awareness efforts (World Bank 2021).

The evolution of air quality policies in Malawi demonstrates an increasing commitment to air quality management, although considerable gaps remain. As Malawi formulates its national air quality standards, it often draws from regional and international guidelines, including those set by the World Health Organization, as benchmark objectives (WHO 2021). The lack of a fully comprehensive and legally binding set of air quality regulations continues to pose challenges. Efforts are ongoing to develop new standards that align with international norms, focusing on pollutants such as PM<sub>2.5</sub>,

PM<sub>10</sub>, nitrogen oxides and ozone, which are known for their direct health implications (Ministry of Health 2021).

## 6.2 Climate

Weather is the state of the atmosphere at a particular moment in time. This is defined by the various meteorological elements, including temperature, precipitation, atmospheric pressure, wind, and humidity. Weather might refer to sunshine, rain, snow, hail, sleet, mist, blizzards, storms, and similar phenomena. Extreme weather events can be any severe or unusual weather event that happens outside normal patterns, or an expected weather event that happens with high intensity during its usual circulation (WMO 2024). Malawi experiences both summer rainfall and occasional winter rainfall. Summer rainfall in Malawi is driven by the intertropical convergence Zone (ITCZ), Congo air, tropical cyclones, convergence ahead of pressure rises, and easterly waves. These systems are influenced by various factors, including mean sea level pressure, upper-level winds, convergence ahead of pressure surge and sea surface temperatures in the tropical Pacific, Indian, and Atlantic Oceans. Winter rainfall is driven by influx of south easterlies off the high pressures passing over south Africa. Malawi has high average air temperatures, ranging from mid-twenties in highlands to mid-thirties in low lying areas.

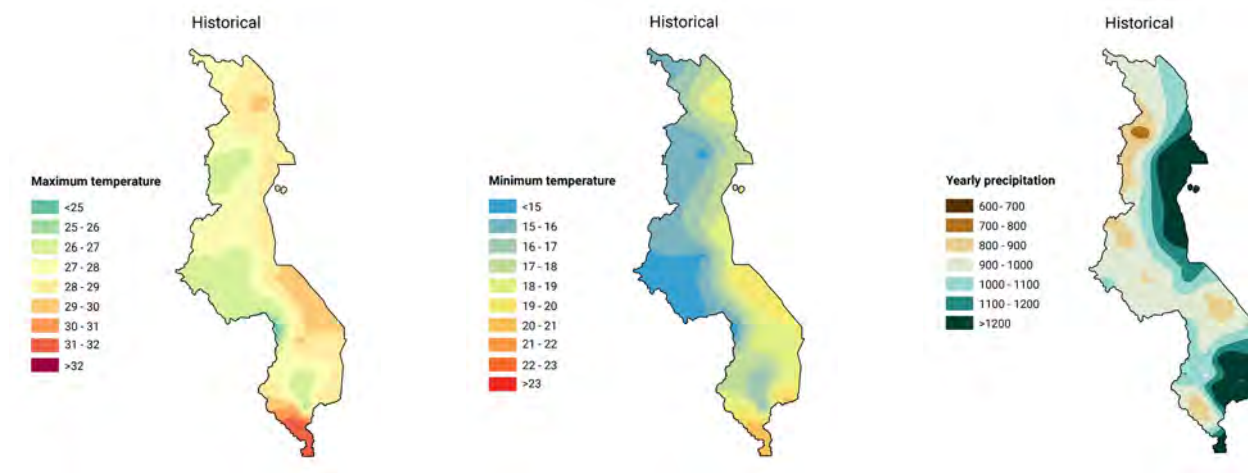


Figure 6.4: Historical yearly precipitation and historical minimum and maximum temperature of Malawi (DCCMS 2024a).

Climate refers to the average weather patterns observed over many years, typically 30, in a specific location. It encompasses long-term records, trends, and averages. Climate is what you anticipate, while weather is what you experience. According to the Koppen climate classification system, Malawi is predominantly sub-tropical with some areas falling in the tropical savannah class (Figure 6.4). Climate change refers to a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean or the variability of its properties, and that persists for an extended period, typically decades or longer (IPCC 2021). It refers to any change in climate

over time, whether due to natural variability or because of human activity. Both weather and climate have the same parameters that include air temperature, atmospheric pressure, wind speed and wind direction, solar radiation, sunshine hours, rainfall, visibility, cloud cover, and so on.

Malawi is characterized by one rainfall season that occurs during the southern hemisphere summer. Annual precipitation ranges between 700 and 2,500 mm, (Figure 6.5) with approximately 95 per cent of the precipitation falling during the warm-wet season from November to April. Winters are generally dry, with

occasional rains, particularly in high-lying areas. Rainfall in Malawi shows significant inter-seasonal and intra-seasonal variability, a pattern further intensified by the effects of climate change. According to the Department of Climate Change and Meteorological Services (DCCMS 2022), rainfall is generally low at the start of the rainy season in October, increasing steadily to over 100 mm in November and ranging from 100 to 250 mm in December, with Salima receiving the highest levels. From January through March, rainfall varies widely across the country, peaking in Blantyre in January and in Salima and Karonga in March, before tapering off across Southern and Central Malawi by April, with minimal rainfall recorded between May and September.

The rainfall season in Malawi usually starts in the southern areas and progressively moves northward to the central and

northern regions. Most areas in Malawi typically experience the onset of rainfall during the first or second week of December (DCCMS 2024a). However, in the southern highlands, except for Mulanje, rainfall generally begins around the fourth week of November. On average, the rainfall season tails off from the fourth week of March to the second week of April across most parts of the country. The season tends to extend in some areas, such as Nkhata-bay. The duration of the rainfall season in Malawi ranges from 90 to 130 days. High-altitude areas and those along the shores of Lake Malawi generally experience a longer season duration. Rain days, defined as any day during the rainfall season from October to April that receives at least 1.0 mm of rainfall, vary from 44 to 94 days, but more rain days are experienced in Nkhata-bay (DCCMS 2024a).

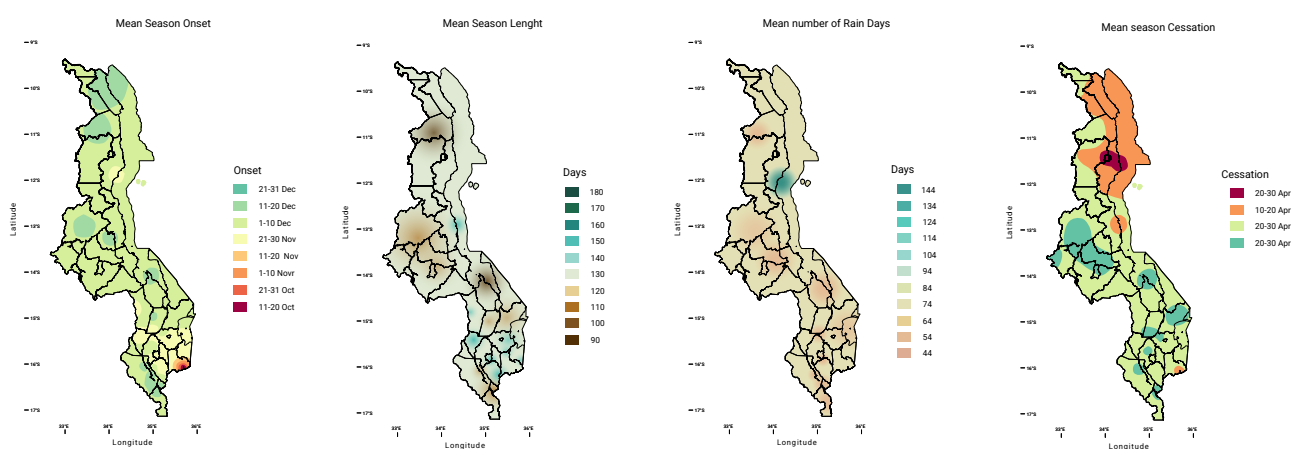


Figure 6.5: Malawi rainfall characteristics (DCCMS 2024a)

### 6.2.1 The climate crisis landscape in Malawi

Malawi is facing escalating climate risks, driven by a combination of rising temperatures, shifting rainfall patterns, and the increasing frequency of extreme weather events such as tropical cyclones. These climatic changes are compounded by environmental degradation from deforestation, rapid and often unplanned urbanization, and weak enforcement of environmental policies. These interconnected challenges are accelerating ecosystem degradation, compromising critical infrastructure, and overwhelming the capacity of communities to adapt and respond to climate change.

Recent climate analyses by the Department of Climate Change and Meteorological Services (DCCMS) highlight significant shifts in rainfall distribution and temperature trends. From January to April, rainfall has generally increased, with pronounced positive trends observed in Karonga in January; Mzuzu and Kasungu in February; Machinga in March; and Mzuzu in April (DCCMS 2022). In contrast, the typically drier months of September through November show a marked decline in precipitation. Mzuzu experiences significant reductions in September, Lilongwe

in both October and November, Salima in October, and Shire Valley and Machinga in September. Blantyre also records decreases in rainfall during September and October, suggesting a trend toward drier pre-rainy seasons (DCCMS 2022).

In addition to changes in rainfall, the characteristics of Malawi's rainy season, such as onset, cessation, intensity, and distribution, have become increasingly variable and unpredictable, accompanied by a rise in extreme weather events (DCCMS 2023). These changes are further exacerbated by a clear and persistent warming trend. Observed maximum and minimum temperatures across Malawi have steadily increased over the past few decades, in alignment with broader regional and global patterns. Notably, maximum temperature anomalies during the October–December period have shifted from negative to strongly positive values since the 1990s, reflecting a significant warming of the summer season (DCCMS 2024a). Figure 6.6 below illustrates the standardized summer temperature anomalies observed from 1970 to 2023, highlighting a clear upward trend in maximum temperatures across the country.

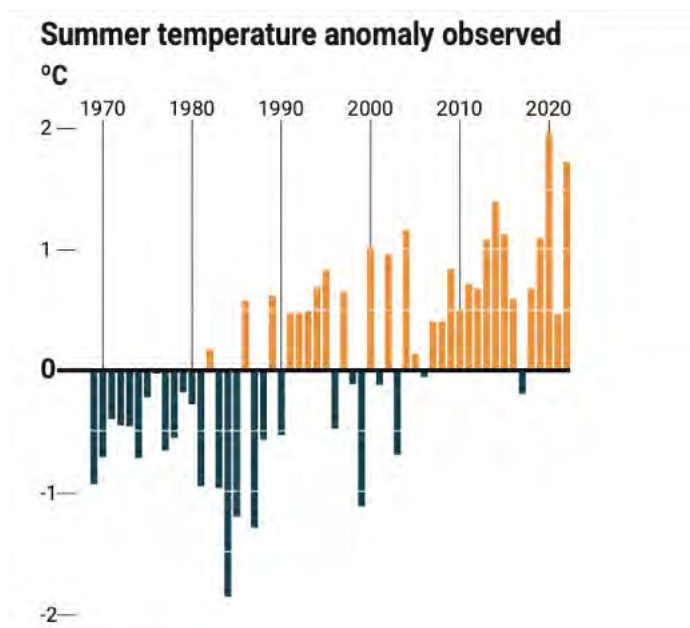
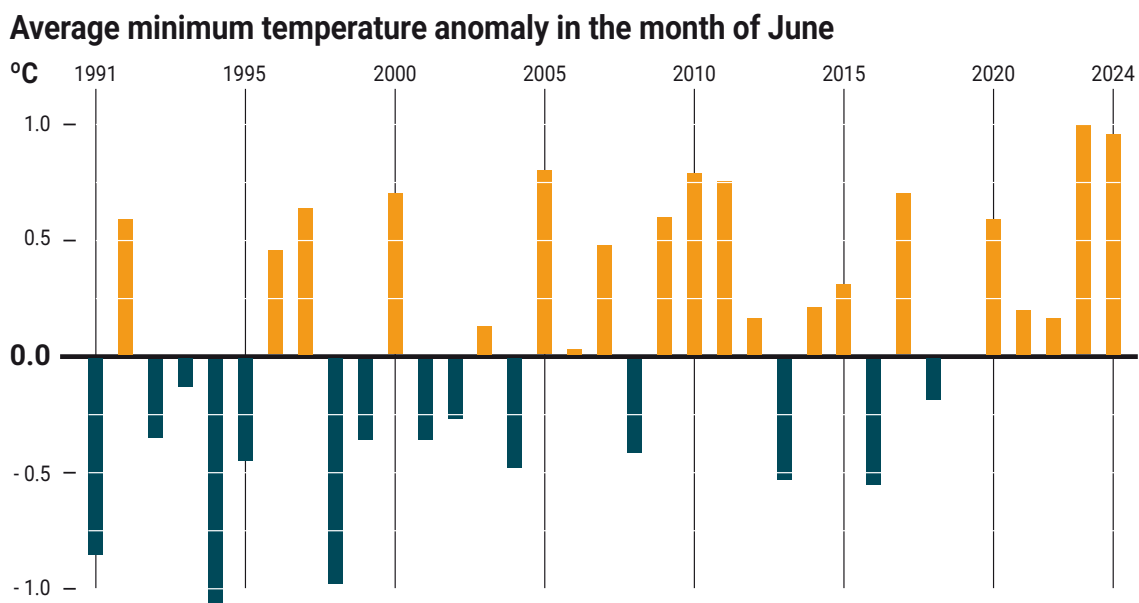


Figure 6.6: Standardized summer temperature anomaly observed from 1970 to 2023 (Source: DCCMS 2024a)

Similarly, minimum temperatures have shown a consistent upward trend from 1991 to 2024 (Figure 6.7), indicating warmer nights and a narrowing diurnal temperature range. While the warming trend varies across regions, the overall trajectory points to a progressively hotter climate. These

temperature shifts pose serious risks to agriculture, water resources, human health, and biodiversity, particularly as prolonged heat stress increases the likelihood of droughts, affects crop productivity, and diminishes water availability.



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Figure 6.7: Average minimum temperature anomaly for June depicting an increasing trend in winter temperature for Malawi (Source: DCCMS 2024b)

## 6.2.2 Exacerbating factors

Climate change is altering Malawi's weather patterns due to rising sea-surface temperatures that fuel stronger cyclones. Deforestation and land-use change reduce natural buffers against storms and floods, while rapid, often unplanned, urbanization concentrates people and assets in hazard-prone zones.

Climate change affects the environment in many ways, including rising temperatures (Figure 6.8), sea level rise, drought, flooding, and more. These events affect water,

energy, transportation, wildlife, agriculture, ecosystems, and human health. Malawi is highly susceptible to severe weather events, including tropical cyclones, severe storms, torrential rains, flash floods, and lightning, which often result in significant damage to infrastructure, livelihoods, and public safety. The country also experiences heatwaves that exacerbate health risks and strain resources, as well as other phenomena like *Chiperoni*, bringing persistent cold drizzles, and *Mwera* winds, creating hazardous conditions over Lake Malawi and other water bodies in the country.

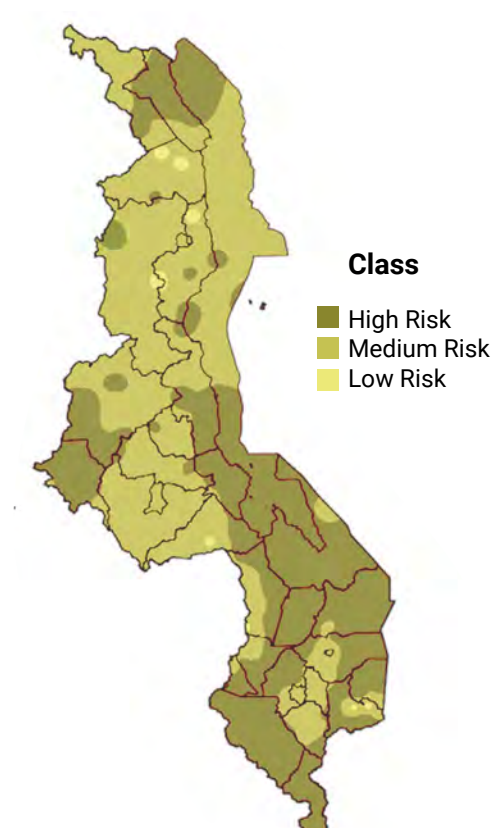


Figure 6.8: A map of Malawi showing the distribution of temperatures and identifying areas at high risk of heatwaves. (DCCMS 2024a)

## 6.2.3 Impacts on society and economy

Malawi is experiencing an increase in temperatures, especially in recent years, raising the risk of heat waves during hot months. Most areas show a positive anomaly in the range of 1 to 2°C in comparison with the long-term averages. Since 2010, Malawi has experienced temperatures in some locations exceeding absolute maximum temperatures. These are extreme heat conditions, impacting livelihoods, livestock, and crops.

The rise in temperatures leads to extreme heat conditions, particularly in the Lakeshore regions and the southern areas, such as the Shire Valley, where maximum temperatures exceeded 36°C. In October 2019, some regions of the country had record-breaking temperatures.

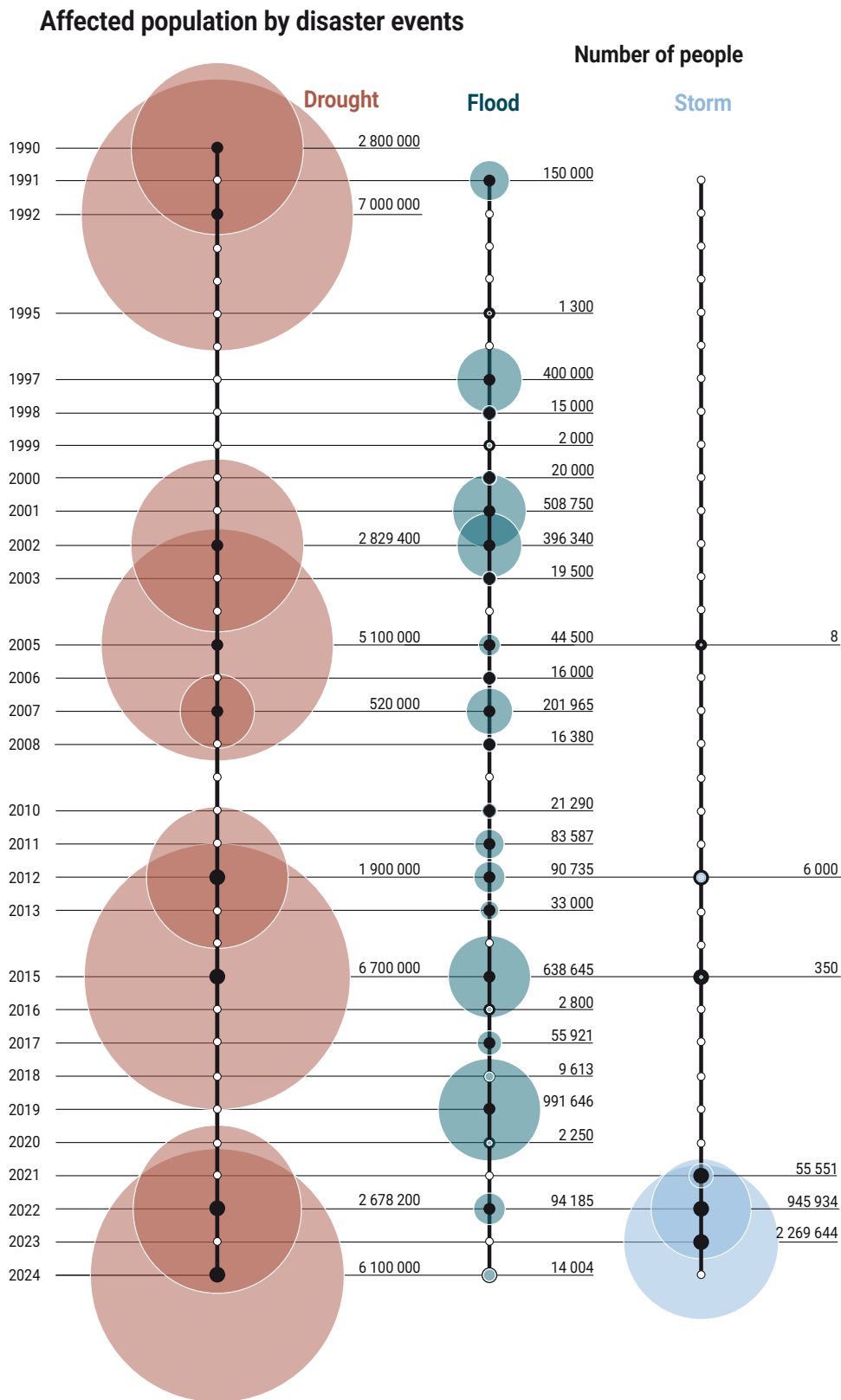
The summer of 2023 was characterized by some areas experiencing temperatures greater than 40°C. In Chikwawa, the Ngabu meteorological station recorded temperatures that were 7.2°C and 5.8°C warmer than the average for the month of October and November 2023, respectively (DCCMS 2023).

Malawi has also already recently witnessed an alarming increase in the frequency and intensity of extreme weather events associated with precipitation and drought, impacting livelihoods and food security (Figure 6.9).

In January 2015, severe tropical storm Chedza formed from the intertropical convergence zone, struck while in the formative stages, bringing heavy rainfall which led to deadly floods following two weeks of precipitation. The

storm caused widespread flooding, particularly in the southern region, submerging homes and farmlands. At least 260,000 people were displaced, and 176 lives were

lost. The floods were marked as the worst in 24 years, prompting the government to request US\$ 430 million in international aid for recovery (ACAPS 2019).



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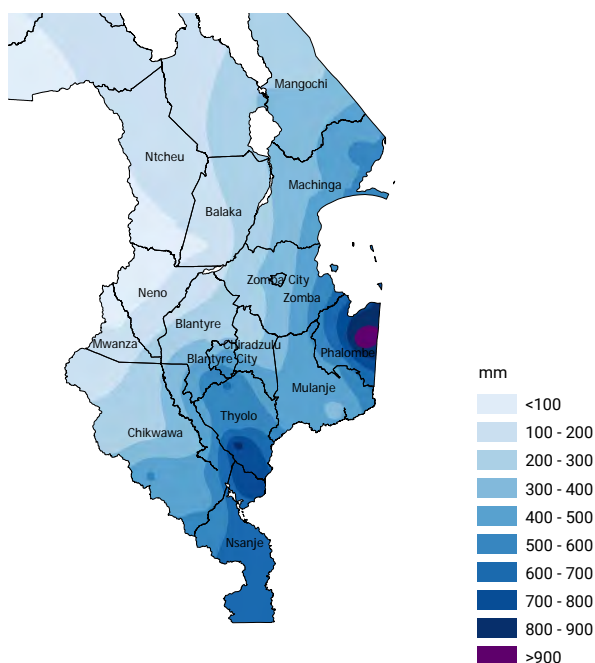
Figure 6.9: Affected population by disaster events from 1990-2024. Number of people affected by drought, flood, storm and mass movement (Centre for Research on the Epidemiology of Disasters (CRED) 2024).

This was followed in March 2019 by Tropical Cyclone Idai one of the most destructive storms to hit Malawi in recent history. Torrential rains caused widespread flooding across 14 districts, damaging infrastructure, including bridges and homes, and affecting over 468,650 people (ACAPS 2019). The districts of Nsanje and Phalombe suffered the worst impacts. Floodwater overwhelmed systems, destroying approximately 1,400 homes in Blantyre and causing dam collapses. Following Idai's second landfall in Mozambique on March 15, Malawi experienced further devastation, including the loss of two hydroelectric power plants along the Shire River. This resulted in a loss of 270 MW of the nation's 320 MW hydroelectric capacity. Nationwide, 922,900 people were affected, including 460,000 children. The disaster displaced or left 125,382 individuals homeless, caused 60 deaths, and injured 577 people, with three missing persons reported.

The trend continued with Tropical Cyclone Ana in January 2022, which caused extensive damage across 16 districts, affecting nearly one million people. This storm resulted in 64 deaths, displaced over 221,000 households, and destroyed vast areas of farmland (DoDMa, 2022a). In

March 2022, Tropical Cyclone Gombe struck, leaving 39 people dead and displacing 11,000 households. Cyclone Gombe affected 11 district councils and 159,226 people (DoDMa 2022b). The back-to-back cyclones overwhelmed Malawi's capacity to recover and led to a state of emergency in the southern region. Weather and climate-related events significantly impact basic rights, including the right to life, health, food, and shelter.

In March 2023, Tropical Cyclone Freddy delivered unprecedented rainfall within just three days, surpassing annual averages (Figure 6.10). According to the Department of Climate Change and Meteorological Services (2023), Tropical Cyclone Freddy was marked by an extraordinary intensity of rainfall reaching as high as 159mm/hr. The resultant deluge posed challenges, overwhelming local drainage systems. The catastrophic flooding and mudslides caused 679 deaths. Entire communities were displaced, major infrastructure such as roads, bridges, and power stations were destroyed, and power outages persisted for weeks. This event compounded the socio-economic challenges, deepening poverty and straining the nation's recovery efforts.



**Figure 6.10:** Cumulative rainfall over southern Malawi (left) and destruction by mudslides in Blantyre (right) during Tropical Cyclone Freddy 2023. (Source DCCMS 2023; Unsustainable Magazine 2023)

Despite the country frequently experiencing flooding, Malawi is also increasingly affected by drought events, with prolonged dry spells becoming more frequent and severe (Figure 6.9). In November 2022, persistent drought conditions delayed the onset of rainfall across much of the country, with most areas experiencing moderate to severe drought. By December 2022, normal rainfall resumed in most regions, highlighting a shift in weather patterns. The 2023/2024 rainfall season, significantly influenced by El Niño, followed a similar pattern. Rainfall onset was

delayed, with substantial precipitation beginning only in mid to late December. This was followed by a prolonged dry spell during a critical phase of maize development. The situation was exacerbated by infestations of fall armyworms, further threatening crops that managed to survive the dry conditions. This marked the third consecutive year that Malawi experienced prolonged dry spells at the start of the rainy season, resulting in delayed germination, failed crops, and increased pest infestations. These recurring conditions presented growing challenges

for farmers, further straining the country's agricultural productivity and food security as well as water resources.

Although drought events are infrequent and slow in onset, their impacts are devastating. They affect a significant portion of the population and severely impact Malawi's agricultural-based economy, leading to notable declines in GDP.

Recurrent cyclones and floods are bringing loss of life, large-scale displacement, and costly damage to homes, schools, and health facilities. Agricultural disruptions drive food insecurity, and service interruptions constrain economic growth. Communities with limited adaptive capacity bear the brunt, deepening existing inequalities. Floods and droughts used to collectively contribute to an annual GDP loss of approximately 1.7 per cent (Pauw *et al.* 2011). With the escalating frequency and intensity of extreme weather events observed in recent years, economic impacts are likely to exceed these earlier estimates significantly.

#### 6.2.4 Policy actions and opportunities

Early-warning systems and disaster-preparedness plans are in place but require broader coverage and steady funding. Strengthening climate-resilient infrastructure, enforcing land-use regulations, and expanding ecosystem restoration, particularly reforestation, can reduce long-term risk. Improving data collection and public awareness will bolster coordinated, evidence-based responses and unlock financing for adaptation to the changing climate.

Malawi, a UNFCCC signatory, is committed to urgent climate action. Its strategic climate policies include Malawi 2063, which emphasizes environmental sustainability as a key development enabler, and the 2016 National Climate Change Management Policy, which guides climate adaptation, mitigation, and finance. In 2021, Malawi launched a National Adaptation Plan Framework to reduce vulnerabilities to climate impacts, complementing its Nationally Determined Contribution (NDC), which targets a 51 per cent reduction in emissions by 2040 across energy, agriculture, waste, and industry sectors. The NDC also prioritizes institutional resilience, knowledge development, and protection for vulnerable populations.

Further reinforcing its climate resilience, Malawi launched the National Framework for Water and Climate Services, focusing on hydrometeorological services to combat the rising incidence of climate-related disasters such as floods and droughts. The National Framework for Water and Climate Services aligns with the Global Framework for Climate Services and the UN Early Warning for All Initiative, aiming to strengthen Malawi's adaptive capabilities. The National Framework for Water and Climate Services addresses key climate services through observation, monitoring, information systems, user platforms, and research. Integrated with Malawi's National Adaptation Plans, the National Framework for Water and

Climate Services exemplifies the country's commitment to reducing climate risks and supporting sustainable development. Malawi has also developed and rolled out a National Disaster Recovery Framework which aims to sustainably improve the resilience of communities affected by the disasters, not only restoring but also improving their livelihoods and infrastructure (Government of Malawi, 2023b).

Malawi has a climate change policy (2017) and a Meteorology policy (2018) meant to enable a coordinated and harmonized approach to Meteorological Services and climate change management.

Malawi's Environmental Affairs Department is mandated to promote, co-ordinate, monitor, and oversee compliance with environmental and natural resources policies, programmes, and legislation. It is also required to monitor, predict, and provide information on weather and climate that would contribute towards the socio-economic development of the country. The Malawi Environment Protection Authority is the principal agency for the protection and management of the environment and sustainable utilization of natural resources. The authority, in consultation with the lead agencies, develops guidelines and prescribes measures for the control and management of factors affecting climate change (Environmental Management Act 2017).

Since 2010, Malawi has made remarkable progress in formulating and implementing climate change response strategies, resulting in increased awareness of the debilitating effects of climate change on key sectors such as agriculture, water resources, and energy. Response strategies are framed in the broader context of national development goals, regional commitments under the Southern Africa Development Community (SADC), and international agreements such as the Paris Agreement.

Adaptation continues to be at the centre of Malawi's climate programmes, which include the Malawi Climate Resilient Agriculture Project that has greatly increased productivity in agriculture through climate-smart practices for smallholder farmers. Similarly, the Shire River Basin Management Programme is working towards ecosystem restoration and flood risk management for the basin.

Malawi has also embraced climate mitigation efforts that include renewable energy projects in the fields of solar and hydropower to reduce greenhouse gas emissions and increase energy security. The Scaling Solar initiative and the current plans for the revitalization of mini-hydropower plants showcase the country's commitment to a low-carbon energy transition. Overall, barriers remain, including insufficient financing, poor infrastructure, and increasing demands that usually result in heavy reliance on biomass and other non-renewable sources.

Emerging trends purport a gradual movement toward more integrated and evidence-based approaches to climate

governance. For instance, the application of geographic information systems and remote sensing technologies has enhanced disaster preparedness and response. Additionally, Malawi has been very active in international climate change negotiations, which has facilitated access to various climate finance mechanisms such as the Green Climate Fund.

Notwithstanding these efforts, there are residual gaps. Among others, interventions on climate change need to be aligned more strongly with national development plans such as Malawi 2063. Adaptation projects also continue

to increase, but monitoring and evaluation is needed to assess the impact of long-term interventions.

Indigenous and Local Knowledge (ILK) is also used to observe, understand, and interpret climatic changes. Communities have long relied on traditional indicators, such as the behaviour of certain animals, the flowering of specific plants, and changes in wind patterns, to predict seasonal changes and rainfall. These indicators, though informal, often complement scientific meteorological forecasts and are vital for local decision-making in agriculture and natural resources management as well as informed early warning systems.

### **Box 6.1: Signs that determine changes in weather patterns**

Traditional knowledge plays a crucial role in interpreting weather changes and guiding agricultural practices and disaster preparedness. Although common signs across much of Malawi, there are some that are area specific.

#### **Zolokere community in Rumphi district (Vwaza Marsh)**

The Zolokere community uses whirlwinds to determine rainfall patterns. For example, when whirlwinds blow regularly from west to east it means they will not receive good rains; when they blow from east to west, the rainfall season will be good. They also use hot weather in summer to predict the possibility of flooding. Fruit trees producing more fruit may be a sign of famine, while when *matontho* trees show greener leaves than usual, it is an indication that the rainy season is approaching.

#### **Khulubvi community**

In the Khulubvi community, reddish skies in the evening and at night, referred to as *changululu*, indicates that the onset of rainy season will be late, typically around December or January. In response to such observations, the community engages in cultural rituals. Chiefs mobilise villagers to make sacrificial offerings to *mbona*, a revered ancestral spirit.

When trees shed more leaves than usual, it is an indication of hunger and famine. When eagles make distinct calls at noon, it is a sign that the rainy season is imminent.



**Nthowe tree species in Nsanje district used as a traditional early warning system. Photo: Alice Kam`mwamba**

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Photo: Helle Biseth.



# 07 Implications of environmental change

**Coordinating Lead Authors:** Margaret Kunje; Fred Simwaka

**Lead Authors:** Hope Baxter Chandimba, Dalitso Kafumbata

**Chapter Fellow:** Mala Kayira

## Executive summary

**Malawi is facing environmental tipping points on many fronts. Climate variability, deforestation, biodiversity loss, and pollution are intensifying and increasingly undermining the country's socio-economy** (*well established*). These environmental challenges intersect with national development priorities, including those outlined in Malawi Agenda 2063 (MW2063) and the Sustainable Development Goals (SDGs). Understanding the implications of environmental change is essential for aligning policies, investments, and actions towards a more resilient and sustainable future. {7.2, 7.3}

**There is a strong link between environmental degradation and key human needs for energy, food security, health, waste management, and poverty alleviation** (*well established*). Environmental change – driven by climate variability, biodiversity loss, and pollution is undermining

Malawi's capacity to achieve its Sustainable Development Goals and the Medium-Term Implementation Plans (MIPs) under Malawi Agenda 2063. Agriculture, energy, manufacturing, and mining sectors are especially vulnerable, facing growing risks from erratic weather patterns, land degradation, resource scarcity, and environmental pollution. {7.1}

**The growing volume of unmanaged waste further strains urban and rural communities alike, calling for stronger policy action and behavioural change** (*well established*). Malawi's development trajectory is increasingly threatened by the convergence of the three planetary crises of climate change, biodiversity loss, and pollution. These crises not only impede socio economic progress but also heighten inequalities and hinder the resilience of vulnerable communities. {7.1.4, 7.3.5, 7.4.3}



Malawi's agricultural sector is vulnerable to erratic weather. Photo: MEPA.

## 7.0 Introduction

In recent years, Malawi has faced a series of environmental changes that have had profound effects on its natural resources, ecosystems, and communities. Driven by a combination of human activities and climate variability, these changes threaten the nation's economic stability, social well-being, food security and the health of its citizens. The primary pressures causing environmental shifts in the country include deforestation, unsustainable land use, increased demand for natural resources, climate change, and pollution. These pressures have not only altered the state of Malawi's natural environment but have also introduced complex challenges that are exacerbated by socio-economic factors, impacting vulnerable groups such as women and youth.

Deforestation remains a major environmental issue in Malawi, driven by the over-reliance on wood for fuel, expansion of agricultural land, and unsustainable logging practices. Forests play a vital role in maintaining biodiversity, regulating the climate, and providing livelihoods to millions of Malawians. The continued depletion of forests has significant implications for carbon sequestration, watershed management, and the country's resilience to climate change. It also hinders progress toward achieving SDG 15 (Life on Land) and compromises related goals such as poverty alleviation (SDG 1) and climate action (SDG 13) (United Nations (UN) 2024a).

One of the most pressing emerging issues in Malawi is the increasing frequency and intensity of extreme weather events, such as droughts, floods, and cyclones. The impacts of climate change have become more apparent in recent years, with a shift in rainfall patterns, rising temperatures, and more erratic weather. These changes disrupt agricultural cycles, water availability, and energy production, posing significant risks to food security (SDG 2), clean water access (SDG 6), and affordable energy (SDG 7) (UN 2024). For example, the El Niño event in 2015/2016 led to widespread drought and food insecurity, affecting over six million people. Similarly, the 2019/2020 season witnessed severe flooding from Cyclone Idai that displaced thousands, damaged infrastructure, and submerged agricultural fields, exacerbating poverty and malnutrition in affected regions.

Water scarcity and pollution are increasingly emerging as critical environmental challenges. The growing demand for water, driven by population growth, industrialisation, and agriculture, is not being matched by sustainable management. Pollution from agricultural runoff, untreated sewage, and industrial waste is contaminating major water bodies such as Lake Malawi. Siltation from deforestation and poor land practices is further reducing water quality and availability. Depletion of groundwater due to unsustainable extraction is also limiting rural access to safe drinking water.

Biodiversity loss, driven by habitat destruction, overexploitation and climate change, threatens critical ecosystem services such as pollination, pest control, and water purification. These services are essential for food security and sustainable livelihoods. Invasive species, like the water hyacinth in Lake Malawi, are further degrading freshwater ecosystems by competing with native species and disrupting the ecological balance.

Rapid urbanization and shifting land use are placing increased pressure on Malawi's environment. Unplanned urban growth has led to deforestation, more waste generation, and inadequate waste management. Urban sprawl is reducing arable land, worsening food insecurity, and threatening smallholder farmers' livelihoods. Infrastructure development is encroaching on natural habitats, reducing biodiversity, and altering ecosystems.

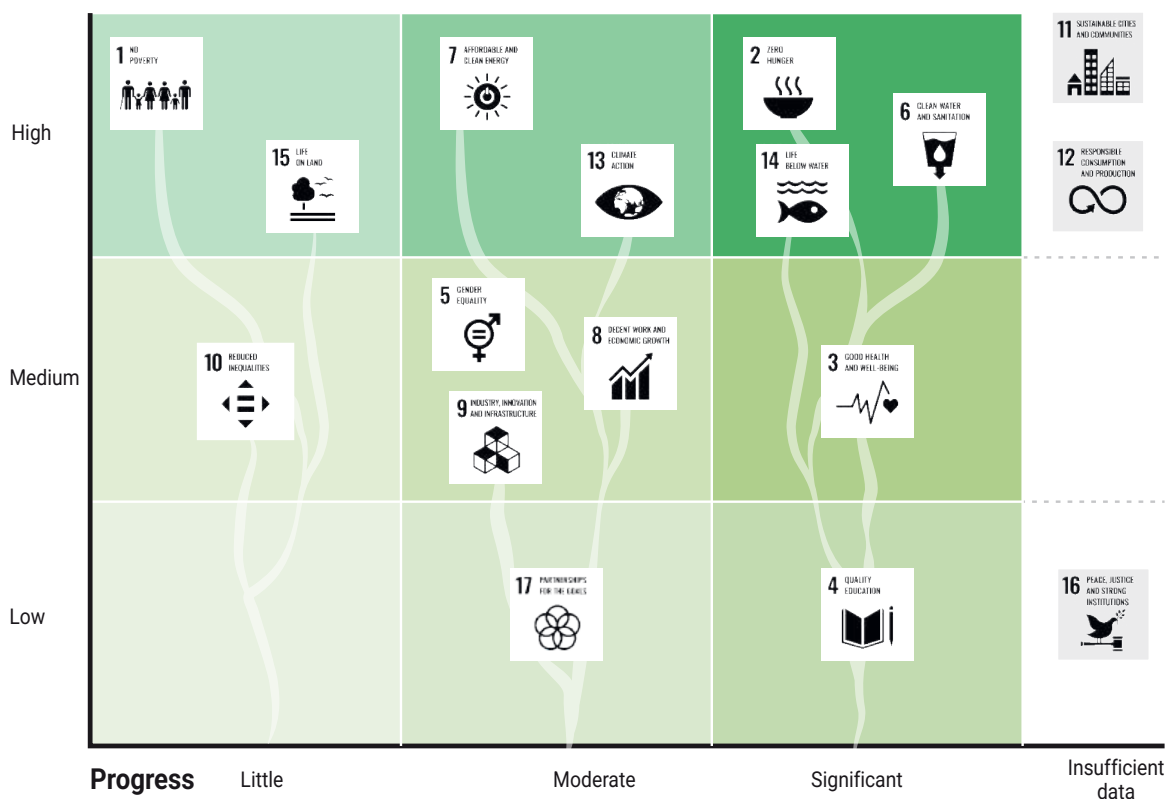
Malawi is making significant progress in five of the SDGs. These include SDGs 2 (Zero Hunger), 3 (Good Health and Well-being), 4 (Quality Education), 6 (Clean Water and Sanitation), and 14 (Life Below Water) (Figure 7.1). The country is also making moderate progress in goals 5 (Gender Equality), 7 (Affordable and Clean Energy), 8 (Decent Work and Economic Growth), 9 (Industry, Innovation and Infrastructure), 13 (Climate Action), and 17 (Partnerships for the goals). However, little or no progress has been made in goals 1 (No Poverty), 10 (Reduce Inequalities), and 15 (Life on Land). Due to insufficient data, progress in goals 11 (Sustainable Cities and Communities), 12 (Responsible Production and Consumption), and 16 (Peace, Justice and Strong Institutions) remains difficult to assess (Gasper *et al.* 2019; UN 2024).



Malawi is making significant progress on five SDGs, including SDG 6 on clean water and sanitation

## Sustainable Development Goals progress and environmental link

### Environmental link



The Sustainable Development Goals progress conducted in 2022 (horizontal axis) categorised based on their relevance to environment (vertical axis).

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**Figure 7.1:** Malawi’s progress on some environmentally relevant Sustainable Development Goals (Government of Malawi 2022).

## 7.1 Implications for human systems

Malawi is increasingly vulnerable to the adverse effects of climate change. Its key human needs for energy, food, health, waste management, and poverty reduction, are intertwined and climate-sensitive. Environmental change not only disrupts these systems but also exacerbates structural vulnerabilities such as poverty. Over the past few years, the country has faced multiple external and internal shocks, including the COVID-19 pandemic and persistent economic challenges. However, climate-related shocks have been among the most devastating. Notably, Tropical Cyclones Ana and Gombe (2022) and Tropical Cyclone Freddy (2023) severely impacted the southern region of the country. Cyclone Freddy alone caused 667 deaths, displaced over 659,000 people, and affected more than 2.2 million people (Government of Malawi 2023a).

### 7.1.1. Energy

The energy sector in Malawi is heavily dependent on hydropower, which accounts for more than 80 per cent of the country’s electricity, and most of it is from the Shire River. Prolonged droughts and erratic rainfall contribute to declining water levels, which compromises electricity

generation. For example, in both 2017 and 2019, frequent and prolonged national load shedding occurred due to low water levels on Lake Malawi and the Shire River, disrupting hospitals, schools, water supply systems, and businesses (Malawi Energy Regulatory Authority (MERA) 2020). Currently, only 19 per cent of the population has access to electricity (World Bank 2023a). As a result, most people rely on biomass for energy, which contributes to deforestation and carbon emissions.

### 7.1.2. Food security

Agriculture remains the backbone of Malawi’s economy, accounting for 30 per cent of GDP and employing over 80 per cent of the population (National Statistics Office (NSO) 2019). The agriculture sector is highly vulnerable to the impacts of floods, droughts, and cyclones whose frequency and intensity are increasing due to climate change. For instance, in 2023, Cyclone Freddy destroyed crops, worsening food insecurity in southern Malawi. The World Food Programme (2023) reported that during that year, over 2.5 million people in Malawi were at risk of hunger due to the loss of crops and arable land. Both climate change and variability undermine food availability and rural livelihoods.

### 7.1.3. Health

Environmental change is placing increasing pressure on Malawi's health system. Rising temperatures and increased flooding have contributed to a surge in vector and waterborne diseases. For example, the 2022–2023 cholera outbreak resulted in more than 1,600 deaths and over 50,000 reported cases (Ministry of Health 2023), which were attributed to water contamination after floods. Malnutrition, particularly in children, continues to be a persistent problem made worse by frequent food shortages, and malaria seasons are lengthening as a result of changing weather patterns.

### 7.1.4. Waste management

Rapid urban growth in cities such as Lilongwe, Blantyre, and Mzuzu has outpaced the development of waste management infrastructure. Generally, there is inadequate waste collection and illegal dumping of waste, which have led to frequent blockages in urban drainage systems, and this is worsened by floods during the rainy season. For instance, in 2022, Blantyre experienced severe flash floods, which were exacerbated by the clogging of drainage systems by municipal solid waste (Government of Malawi 2023b). Open waste burning and poor landfill management also contribute to environmental pollution and public health risks.

### 7.1.5. Poverty

More than 50 per cent of the population in Malawi lives below the national poverty line (World Bank 2022). High poverty levels increase the vulnerability of the population to climate change. Since 1980, the country has recorded more than 50 climate-related disasters, with half of them occurring in the past decade alone (Government of Malawi 2023a). These events continue to erode household incomes, displace communities, and damage infrastructure. For instance, Cyclone Freddy caused damages exceeding US\$500 million, disproportionately affecting women, children, people with disabilities, and informal workers (World Bank Group 2023a). Climate-induced poverty is also closely linked to Malawi's dependence on natural resources because when these resources are degraded by droughts or floods, entire livelihoods are disrupted, leading to food insecurity, forced migration, and reduced access to social services. The World Bank (2022) warns that, under a "business-as-usual" scenario, climate change could cause annual GDP losses of up to 20 per cent by 2040 and further entrench social and economic inequalities.

## 7.2 Implications for Agenda 2063 targets

Environmental change directly impacts five critical sectors of Malawi's economy as described in the Malawi Agenda 2063: agriculture, energy, manufacturing, mining, and tourism. Malawi's Agenda 2063 is the country's long-term development blueprint which is aligned with the African

Union's continental vision and envisions "an inclusively wealthy and self-reliant nation" (Government of Malawi 2020). The Malawi 2063 target sets an annual GDP growth rate of between 6.2 per cent and 7 per cent (NSO 2022). However, a review of recent economic performance indicates a notable disparity between the target and actual growth rates. Specifically, the GDP growth rate has fluctuated, ranging from a high of 5.5 per cent in 2019 to a low of 0.9 per cent in 2022, with an average GDP growth rate of 4.6 per cent over the period (NSO 2022). The vision faces significant challenges from escalating environmental changes, including climate variability, extreme weather events, and natural resource degradation. These environmental shifts disproportionately affect key economic sectors and exacerbate existing gender inequalities in a country where 83 per cent of the population live in rural areas (McBride and Moucheraud 2023), depending largely on natural resources for their livelihoods.

### 7.2.1. Agriculture

Agriculture remains Malawi's economic cornerstone, contributing approximately 30 per cent to GDP and employing over 80 per cent of the workforce (NSO 2022). Women constitute 70 per cent of the agricultural labour force yet own only 32 per cent of agricultural land (UN-Women 2023). This gender disparity in asset ownership amplifies women's vulnerability to environmental changes. The increasing frequency of droughts and floods has devastated agricultural productivity in Malawi. The 2021-2022 growing season saw a 43 per cent reduction in maize yields following Tropical Storm Ana and Cyclone Gombe, and affected 3.8 million people (FEWS NET 2022). Female farmers suffered disproportionately, with surveys showing their crop losses were 18 per cent higher than male counterparts due to limited access to climate information, improved seeds, and irrigation technology (Food and Agriculture Organization (FAO) 2023a). Climate-smart agriculture initiatives show promise for enhancing resilience. Projects implementing conservation agriculture techniques have increased yields by 30 per cent during drought years (Ministry of Agriculture 2023). However, the adoption rate among female farmers stands at just 27 per cent compared to 46 per cent for male farmers (NSO 2022).

### 7.2.2. Energy

Malawi's energy sector faces dual challenges, such as extremely low electricity access which is at only 25 per cent nationally, and heavy reliance on biomass energy which is at 86 per cent of total energy consumption for cooking, primarily from fuelwood and charcoal (Ministry of Energy 2023). Environmental degradation threatens this unsustainable energy system, with forest cover decreasing by 1.6 per cent annually (Department of Forestry 2022). The energy crisis manifests differently across gender lines. Women and girls spend an average of 5 hours weekly collecting fuelwood, compared to

1.4 hours for men (Gender and Energy Survey 2023). This burden has increased by 37 per cent over the past decade as deforestation forces longer collection journeys. Furthermore, women's exposure to indoor air pollution from traditional cooking methods results in 4,800 premature deaths annually, primarily affecting women and children (World Health Organization 2023).

### 7.2.3. Manufacturing

Malawi's manufacturing sector contributes approximately 9.5 per cent to GDP, with agro-processing dominating the landscape (NSO 2023). Environmental changes disrupt this sector through unstable agricultural inputs, energy insecurity, and water scarcity. The 2022-2023 drought reduced industrial water availability by 38 per cent, forcing industrial processing plants to operate at reduced capacity (Malawi Confederation of Chambers of Commerce and Industry 2023).

Women represent only 32 per cent of the manufacturing workforce, concentrated in low-skilled, poorly paid positions (Malawi Labour Force Survey 2022). Environmental disruptions exacerbate this inequality, as women are typically the first to lose employment during downscaling. Following the 2022 flooding that damaged textile factories in Blantyre, female job losses outpaced male losses by 3:1 (Labour Market Impact Assessment 2023). The manufacturing sector's vulnerability stems from its concentration in flood-prone areas, with 62 per cent of factories located in high-risk zones (Department of Disaster Management Affairs 2022).

### 7.2.4. Mining

The mining sector contributes approximately 3 per cent to Malawi's GDP but features prominently in the country's development vision (Reserve Bank of Malawi 2023). The sector faces intensifying environmental pressures, with changing rainfall patterns increasing siltation of waterways and extreme weather damaging mining infrastructure. The Kayerekera uranium mine suspended operations partially due to water management challenges exacerbated by climate variability (Mining Review Africa 2022). Mining's formal workforce remains overwhelmingly male, with women comprising only 7 per cent of employees (Chamber of Mines 2023). This gender imbalance creates skewed benefit distribution in mining communities. However, women bear disproportionate environmental costs, such as through contaminated water sources they depend on for household use affecting 76 per cent of households in mining areas, degraded agricultural land reducing food production capacities, and respiratory illnesses from mining dust having a 27 per cent higher prevalence in women than men in mining communities. A survey of communities surrounding the Kayelekera uranium mine revealed that 82 per cent of women reported significant declines in water quality compared to 54 per cent of men (Environmental Affairs Department

2023). This disparity reflects women's greater interaction with water resources for domestic needs.

### 7.2.5. Tourism

Tourism contributes 7.7 per cent to Malawi's GDP and 6.2 per cent to total employment (World Travel & Tourism Council 2023). The sector relies heavily on natural assets, particularly Lake Malawi, wildlife reserves, and mountainous landscapes, all increasingly threatened by environmental change. Lake Malawi's water levels have decreased by 1.8 meters over the past decade, while biodiversity in protected areas faces pressure from changing habitats and human encroachment (Department of Climate Change and Meteorological Services 2023). Women constitute 41 per cent of the tourism workforce but hold only 18 per cent of managerial positions (Department of Tourism 2023). Gender segregation concentrates women in accommodation services (76 per cent female) and food preparation (82 per cent female), positions which are most vulnerable to seasonal fluctuations and environmental disruptions. Climate vulnerability assessments of tourism sites show that female-dominated sub-sectors face 43 per cent higher risk of disruption from extreme weather events than male-dominated sub-sectors (Ministry of Tourism 2023). When tourism operations downscale due to environmental events, women experience unemployment rates 2.3 times higher than men (Labour Market Assessment 2022). However, community-based ecotourism initiatives present opportunities for gender transformation. Women-led homestay programmes in the buffer zones of protected areas have increased household incomes by 38 per cent while reducing pressure on forest resources (Wildlife and Environmental Society of Malawi 2023). These initiatives typically include sustainable practices like rainwater harvesting and organic gardening, building climate resilience while empowering women economically.

## 7.3 Implications for Agenda 2030

### 7.3.1 Zero Hunger and Poverty Alleviation

Agricultural practices in Malawi, an agro-based economy, are deeply shaped by the impacts of environmental change, which consequently affects productivity and food security. Due to economic pressures, many smallholder farmers are forced to rely on subsistence strategies that cause deforestation and land degradation (Marsh *et al.* 2009; Fisher and Shively 2007). This undesirable trade-off undermines long-term land productivity and environmental sustainability, which exacerbate the impact of climate change. The country continues to face frequent droughts and floods that reduce agricultural productivity, damage infrastructure, and contribute to annual economic losses of approximately 1.7 per cent of GDP (Pauw *et al.* 2010; World Bank 2018). These climate shocks exacerbate food shortages and lead to inflation in staple food prices (Dorward and Chirwa 2011). The country's vulnerability

to climate change is amplified by projections of declining annual rainfall, potentially up to 20 per cent by the 2080s, which threaten water availability and food security (Calzadilla *et al.* 2015; IPCC 2022). Additionally, high dependence on rain-fed agriculture and limited access to irrigation and extension services further reduces the national resilience (FAO 2017). These dynamics reveal the urgent requirement for the country to adopt sustainable agricultural interventions, such as conservation agriculture, agroforestry, and improved water harvesting, to achieve national targets on food security (FAO 2013; Stringer *et al.* 2020).

### 7.3.2. Life on Land and Water

Environmental changes are increasingly disrupting ecosystems and threatening biodiversity in the country. Human activities, such as deforestation, overfishing, and land conversion, continue to stress ecological systems. For example, there is a decline in fish populations, especially the endemic cichlid species in Lake Malawi, which is mainly driven by unsustainable fishing practices, pollution, and habitat degradation (FAO 2022; Weyl *et al.* 2010). Seasonal fluctuations in food and water availability further affect species survival and reproduction (Bashir *et al.* 2015; Government of Malawi 2015). Generally, habitat degradation also diminishes ecosystem services like water purification, soil fertility and climate regulation, thus compromising the ability of the communities to achieve sustainable livelihoods and food security (Millennium Ecosystem Assessment 2005). The interconnections of forests, fisheries, and agriculture call for ecosystem-based management, which promotes the achievement of the human development without compromising the ecological integrity (Zerbi *et al.* 2003; CBD 2020).

### 7.3.3. Clean Water and Sanitation (SDG 6)

Malawi is making improvements in access to improved water sources, but the progress is still slow (WaterAid 2023). Statistics show that access to improved water sources in urban, peri-urban, town, and market centres is at 97.1 per cent, whereas in rural areas it is at about 88.3 per cent (Government of Malawi 2023b). About 60 per cent of the population in the country does not have access to improved sanitation (WaterAid 2023). In all major cities, waste collection services are below 30 per cent, and as such open dumping of waste is prevalent (Njewa *et al.* 2022; Chikukula *et al.* 2024). Environmental change may exacerbate these undesirable results as more people move to urban areas, where water and sanitation infrastructure is not adequate to support the growing population (United Nations Human Settlements Programme (UN-Habitat) 2024).

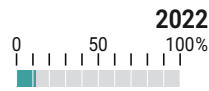
Environmental change coupled with high population growth are significantly contributing to water scarcity (HLPF 2018; Edmonds *et al.* 2021). Additionally, continued global warming is projected to further increase the frequency and severity of droughts and floods, both of which will affect access to water and sanitation (Government of Malawi 2023b). Environmental changes will influence river discharge due to changes in the level of precipitation (Abbass *et al.* 2022; Miralles-Wilhelm *et al.* 2017), and reduced precipitation may lead to droughts (United Nations 2024). A reduction in precipitation also affects groundwater levels through its influence on the amount of water available to aquifer recharge. In places where availability of surface water is expected to decrease, there will be overreliance on groundwater to meet demand (UNFCCC 2011). However, there will be a risk of groundwater storage depletion if discharge exceeds recharge, thus exacerbating water supply challenges (United Nations 2022). Water scarcity may affect the attainment of water and sanitation targets under Sustainable Development Goals (Alshomali and Gulseven 2020; Edmonds *et al.* 2021). Figure 7.2 shows the level of water stress in Malawi when compared with other countries.



Malawi is affected by seasonal fluctuations in food availability. Photo: Marisol Soledad Estrella.

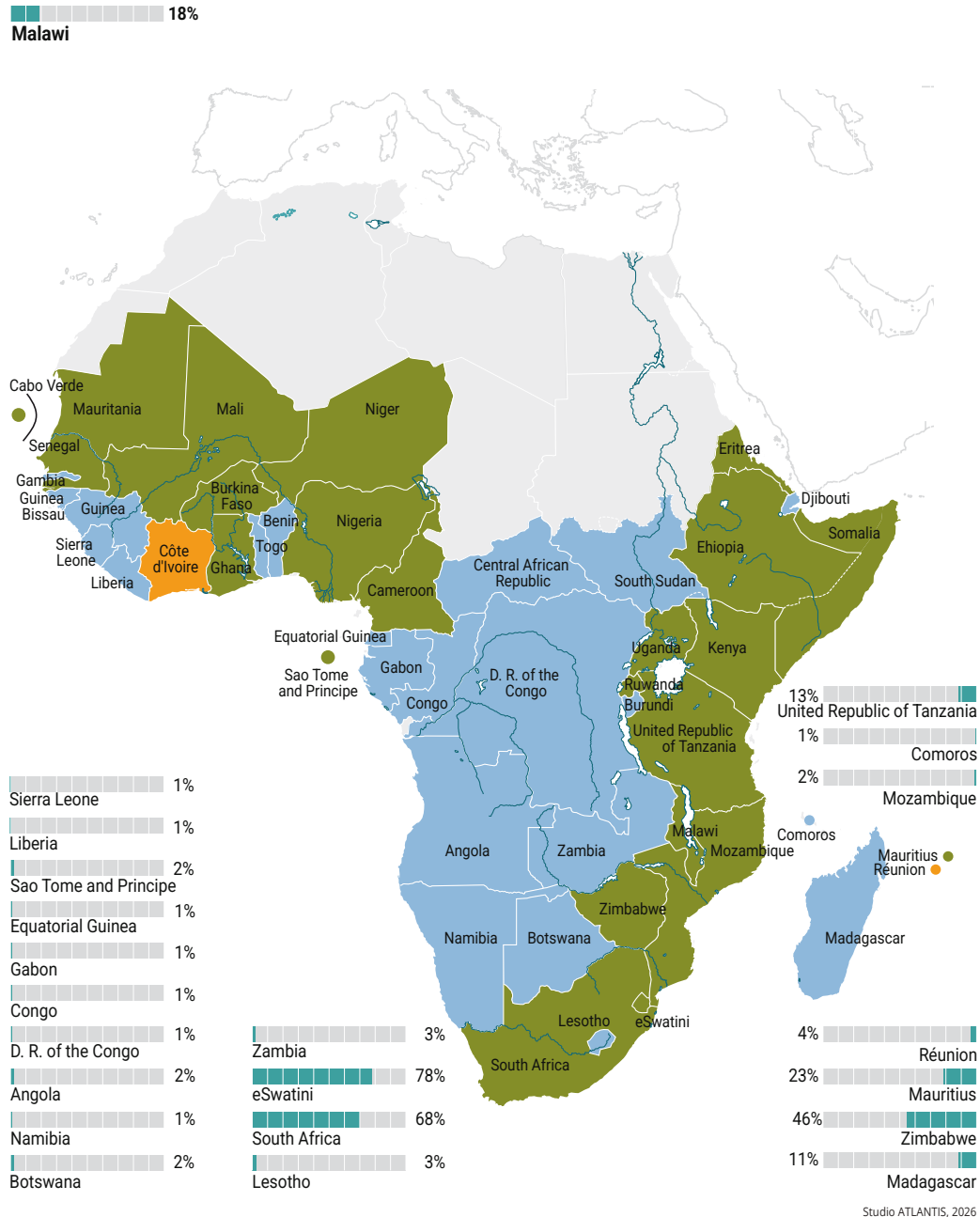
## Level of water stress

Freshwater withdrawal  
as a proportion of available  
freshwater resources



Change  
2000 - 2020

increased stable decreased



**Figure 7.2:** Levels of water stress in Malawi as compared to other countries (United Nations 2024b).

Due to climate change, other regions may receive excessive rains, which can lead to frequent flooding (UNFCCC 2011). Such floods contribute to human displacements, which are associated with multiple socio-economic challenges. For example, displacement camps established during floods in Malawi have been characterised by multiple challenges, including limited access to clean water and sanitation services (OCHA

2023). The flooding also destroys the critical water supply and sanitation infrastructure, which is already limited and not adequate to support the populations (Government of Malawi 2023b; Abbass *et al.* 2022; WaterAid 2023). With limited access to land, many people will start to settle in fragile areas, including near rivers, which contributes to contamination of water resources as waste generated may lead to pollution of water resources (International

Organization for Migration (IOM) 2023). One of the major challenges the water sector in Malawi is already facing is water resources degradation resulting from high levels of sedimentation, effluent discharges, and solid wastes disposal in water bodies (Government of Malawi 2023b; Chikukula *et al.* 2024; Njewa *et al.* 2022).

### 7.3.4. Affordable Energy and Clean Energy (SDG 7)

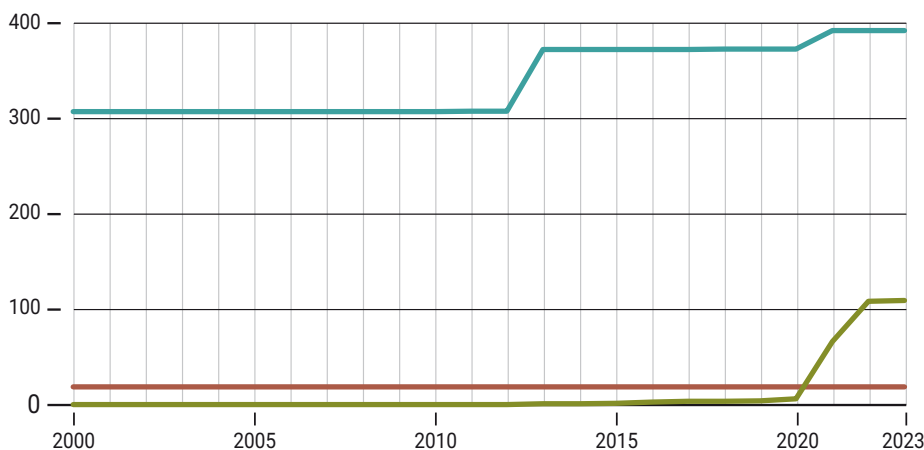
As of 2024, it is estimated that access to energy at national level is at 25 per cent, with urban and rural having access rates of 57 per cent and 10 per cent, respectively (Jumbe *et al.* 2022). This means that the challenge of providing access is severely difficult in rural areas, where electricity is regarded as a privilege and not a right (McCauley *et al.* 2022). With limited access to alternative modern and affordable energy sources, many households are forced to rely on environmentally unfriendly fuels for cooking and lighting, such as, agricultural waste, firewood, and charcoal, which are blamed for indoor emissions and the associated respiratory illnesses amongst women and children (Bruce *et al.* 2000; Aemro *et al.* 2021; McCauley *et al.* 2022; Ubaid *et al.* 2021).

Environmental change has the potential to exacerbate the challenge of energy access in Malawi, and prevent

the country from achieving the SDG 7, which is focused on ensuring universal access to affordable, reliable, sustainable, and modern energy for all by the year 2030. Currently, about 80 per cent of Malawi’s electricity supply comes from hydroelectric power plants (Jumbe *et al.* 2022; Kachaje *et al.* 2016; Government of Malawi 2023c), and of this electricity, 99 per cent is dependent on the Shire River. Malawi is one of the most vulnerable countries to the impacts of climate change around the world (Warnatzsch and Reay 2019; Government of Malawi 2023b), which have the potential to exacerbate the existing problems of water availability for hydropower generation (Cronin *et al.* 2018; Kachaje *et al.* 2016; JICA 2022). Reduced rains raise the risk of no outflows if the Lake Malawi outflow threshold is passed (Bhave *et al.* 2020; Ubierna and Karki 2022). For example, the prolonged dry spells of 2015 reduced hydropower generation by two-thirds on the Shire River (Warnatzsch and Reay 2019). In addition, the country was hit by Tropical Cyclone Ana in 2022, which damaged a 129 MW hydropower plant at Kapichira, consequently reducing power supply and contributing to frequent power outages across the country (JICA 2022; Government of Malawi 2023a). Figure 7.3 shows a gradual increase in solar power installations, with hydropower still dominating Malawi’s energy mix.

### Electricity installed capacity

Megawatt



Hydropower



Solar



Solid Biofuels

Studio ATLANTIS, 2026

**Figure 7 3:** Electricity installed capacity in Malawi (*International Renewable Energy Agency (IRENA) 2024*).

Environmental change also contributes to variability of wind and solar resources as well as the availability of bioenergy (Cronin *et al.* 2018). With an increasing gap in modern energy supply and demand, it should be anticipated that the country will not be able to reduce its dependence on biomass, consequently exacerbating the challenge of deforestation and environmental

degradation, which threatens livelihoods and hampers the efficiency of existing systems (McCauley *et al.* 2022). With increased rates of deforestation, the supplies of firewood and charcoal will continue to dwindle, thus becoming less accessible and unaffordable (Innovate UK and UK Aid 2023).

### 7.3.5. Sustainable Cities (SDG 11)

Malawi is a fast urbanising country, with its urban population rising from 2.0 million in 2008 to 2.8 million in 2018, increasing from 14.9 per cent to 16 per cent of the national total (Government of Malawi 2021). This growth is largely driven by young, poor, and unskilled rural migrants (Government of Malawi 2020). Over 70 per cent of those migrating from rural to urban areas tend to settle in informal settlements (Government of Malawi 2023b). Urban infrastructure has failed to keep pace, resulting in poor housing and limited access to energy, water, and sanitation (Neumann 2019; UNICEF 2022). Environmental change further undermines sustainable urban development. Natural disasters, such as Cyclones Ana and Freddy, have caused significant damage to roads, bridges, health facilities, and water systems in major cities (Government of Malawi 2021; DoDMA 2023; UNICEF 2022), disrupting basic services and displacing communities (Proudman 2020; Almusaed and Almssad 2019). These climate shocks drive rural-urban migration, increasing urban vulnerability (Government of Malawi 2021). The destruction also forces the government to divert resources to disaster response, straining public finances and weakening fiscal stability (Government of Malawi 2020; 2023a). Furthermore, droughts reduce water availability and hydropower output, while floods destroy essential infrastructure (Cronin *et al.* 2018; Warnatzsch and Reay 2019; JICA 2022), compounding urban service delivery challenges (Government of Malawi 2020; 2021).

### 7.3.6. Responsible Consumption (SDG 12)

Population growth usually increases the demand for natural resources, leading to overexploitation and environmental damage, which threaten livelihoods (Almulhim *et al.* 2024). The 2030 Agenda, among others, seeks to decouple economic growth from resource utilisation and environmental damage through responsible consumption and production (Gasper *et al.* 2019). However, environmental change has the potential to disrupt livelihoods as well as reduce the opportunities for diversifying sources of livelihoods, thus exacerbating the challenge of resource overexploitation and environmental degradation (Almulhim *et al.* 2024; Kwanhi *et al.* 2024). Environmental changes may contribute to high levels of poverty. Many people will continue to rely on low-value livelihood strategies (World Food Programme, 2022). This will exacerbate the challenge of rural to urban migration (Almulhim *et al.*, 2024; Tietjen *et al.*, 2024). The available resources in urban areas may not sustain population growth (National Planning Commission (NPC) 2020; Tietjen *et al.* 2024). Consequently, this will put more pressure on the available resources and contribute to overexploitation and environmental damage (Government of Malawi 2015). Already, with limited economic opportunities, many people are turning to fishing to provide their families with food and income (Maguza-Tembo 2014). In 2015, it was reported that the number of fishers in the country increased by 124 per cent in ten

years (Government of Malawi 2015). Due to this, Malawi has been experiencing overfishing, which threatens the supply of proteins and has led to a decline in population of some fish species, such as, Chambo (*Oreochromis spp*) (Government of Malawi 2015; Maguza-Tembo 2014). In addition, more people highly depend on forests to support their families through firewood and charcoal production and supply, thus contributing to high rate of deforestation (Government of Malawi 2015).

### 7.3.7. SDG 5 on Gender

Women play a critical role in the agricultural sector, contributing between 50 and 70 per cent of all agricultural labour and producing nearly 70 per cent of the country's food (FAO 2011; UN Women 2019). However, climate change is intensifying gender inequalities, increasing women's workload, especially in water and firewood collection and subsistence farming, at a time when natural resources become scarcer (Chibowa *et al.* 2020; Government of Malawi 2020). Rural women are particularly vulnerable due to limited access to land, credit, agricultural inputs, and decision-making processes (World Bank 2016; UNDP 2022). Their adaptive capacity is constrained by socio-economic barriers, including high input costs, limited education, and restricted access to extension services (ActionAid 2021; UN Women 2019). Disasters such as Cyclones Ana (2022), Gombe (2022), and Freddy (2023) disproportionately affected women, with many men migrating to urban areas for work and leaving women to manage households and farms alone (DoDMA, 2023; Government of Malawi 2023a). These burdens reinforce gendered care roles and reduce women's opportunities for income generation and resilience-building (Oxfam 2022).

## 7.4. Implications and the three planetary crises

Malawi faces severe environmental challenges, including climate change, biodiversity loss, and pollution. These three planetary crises are deeply interlinked in many ways.

### 7.4.1. Climate change

Malawi is one of the countries that is facing a rapid intensification of extreme weather events in southern Africa due to cyclones, floods, and droughts, which disproportionately affect the population. For instance, cyclones Freddy, Ana, and Gombe caused severe destruction to human life and infrastructure (Changwanda and Clayton 2023; United Nations Office for Disaster Risk Reduction 2024; UNEP 2023). More than 80 per cent of the population in Malawi relies on rain-fed agriculture, which is severely impacted by fluctuating rainfall and temperature patterns. Therefore, these impacts of climate change continue to increase the risk of food insecurity (Changwanda and Clayton 2023; FAO 2023b; IPCC 2022). Apart from negatively impacting the agriculture sector, these weather events also strain Malawi's hydroelectric power generation, which accounts for more than

80 per cent of the country’s electricity supply. Usually, reduced rainfall causes erratic river flows, especially in the Shire River basin, which contributes to frequent power outages that negatively impacts delivery of critical services and economic productivity (International Hydropower Association 2023). In addition, climate change is blamed for rising temperatures and frequent flooding, which escalates the spread of waterborne diseases and vector-borne diseases (WHO 2023; UNICEF Malawi 2023). The impact of these weather events on the economy is severe. For instance, the fiscal impact of Cyclone Freddy alone exceeded US\$1 billion, and the World Bank projects that climate change could reduce Malawi’s GDP by up to 20 per cent by 2040 (World Bank 2023).

### 7.4.2. Nature and biodiversity loss

Malawi is experiencing rapid biodiversity loss and ecosystem degradation. It is estimated that 33,000 to 42,000 hectares of forest are lost annually due to human activities, such as agriculture, charcoal production, and settlement expansion (Ngwira and Watanabe 2019; Global Forest Watch 2024; UNEP-WCMC 2023; Chirwa *et al.* 2022). The reduction in soil cover contributes to soil erosion, reduced fertility, and disrupted hydrological cycles, among others (FAO 2023b). Currently, several crucial biodiversity hotspots in Malawi, such as Mount Mulanje’s unique cedar forests, are under severe threat due to illegal logging and forest encroachment, affecting some endemic species (IUCN 2024). Other important sites, such as wetlands, lakes, and protected areas, are equally strained by habitat encroachment and diminishing critical ecosystem services (BirdLife International 2023). Fisheries in Lake Malawi, a vital protein and livelihood source for many Malawians, are also in decline due to overfishing

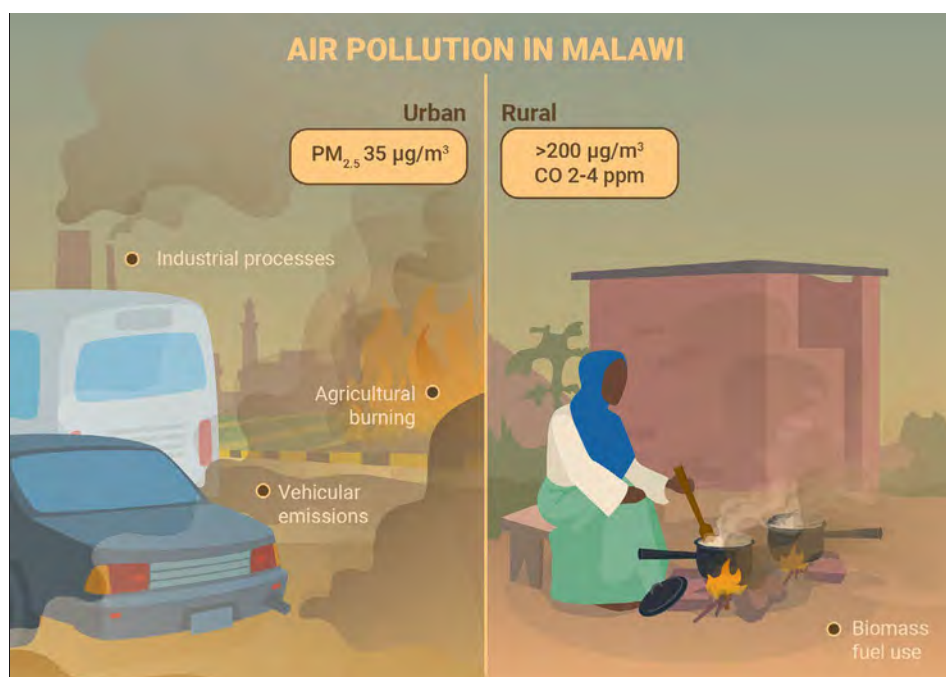
and habitat degradation. It is estimated that Lake Malawi has lost up to 90 per cent of several important species, including *kampango* and *chambo* (Global Forest Watch 2024; WWF 2023; FAO 2022).

### 7.4.3. Pollution

Malawi is facing rapid urbanisation, which is outpacing the development of waste management systems (WFP 2023; PreventionWeb 2023; UN-Habitat 2023). More waste is generated than what the local authorities can properly collect and dispose of. Thus, more waste is dumped into the environment, causing air, water, and soil pollution, which exacerbates existing vulnerabilities. For instance, during Cyclone Freddy, the clogging of water drainage systems accelerated flood impacts and fuelled cholera outbreaks (WFP 2023; UNICEF 2024).

Indoor air pollution is prevalent in rural Malawi and is a challenge that affects human health. Generally, the majority of the households in Malawi are dependent on biomass fuel in the form of firewood, crop residues, and charcoal for cooking. These fuels expose women and young children to indoor emissions that cause respiratory illnesses (WHO 2023; Clean Cooking Alliance 2023).

Without proper regulations, untreated industrial effluent is discharged into rivers like the Likangala. This compromises water quality and increases the incidence of waterborne diseases in the communities that depend on the river (WaterAid Malawi 2023). Additionally, soil degradation from pesticide use, chemical runoff, and waste disposal practices negatively affect agricultural productivity and in the long-term compromises food safety (FAO 2022; UNEP 2023).



**Figure 7.3:** Women and young children are the most exposed group to indoor air pollution.

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*Photo: Kondwani Jere Kondwani Jere..*



# 08 Data challenges

**Coordinating Lead Author:** Sautso Wachepa  
**Lead Authors:** Jeremot Masoambeta; Leonard Nyanjagha  
**Chapter Fellow:** Justin Ng'ambi

## Executive summary

**Malawi's progress towards the Sustainable Development Goals, Malawi Agenda 2063 (MW2063), and effective environmental management are constrained by serious data gaps, weak monitoring systems, and limited institutional coordination** (*well established*). Weak environmental data systems affect Malawi's ability to forecast and prepare for climatic shocks; monitor air and water pollution; manage forests, land degradation, and biodiversity loss; design and evaluate climate and environmental policies; attract climate finance and support district-level planning and community resilience. {8.2}

**Environmental data in Malawi; including on land use, biodiversity, forest cover, water quality, climate and pollution levels; is governed by a patchwork of laws and policies** (*well established*). These laws shape what data is collected, who can share or access it, and how it must be protected. Key policies and laws on environmental data include the National Statistics Act (2013), Access to Information Act (2016), Data Protection Act (2024), and Electronic Transactions and Cybersecurity Act (2016). There are also sector-specific data policies such as National Meteorological Policy (2019), National Health Information System Policy (2015), and National Information and Communications Technology (ICT) Policy (2013). {8.3.1}

**Though there are laws that govern data collection and sharing, there are still inadequate baseline and monitoring systems** (*well established*). Data on environmental indicators are not routinely collected or harmonised. Environmental data is scant, inaccurate, inconsistent, and fragmented across various sources. There is no standardisation, leading to comparability and quality challenges. {8.3.1; 8.3.2; 8.4.1}

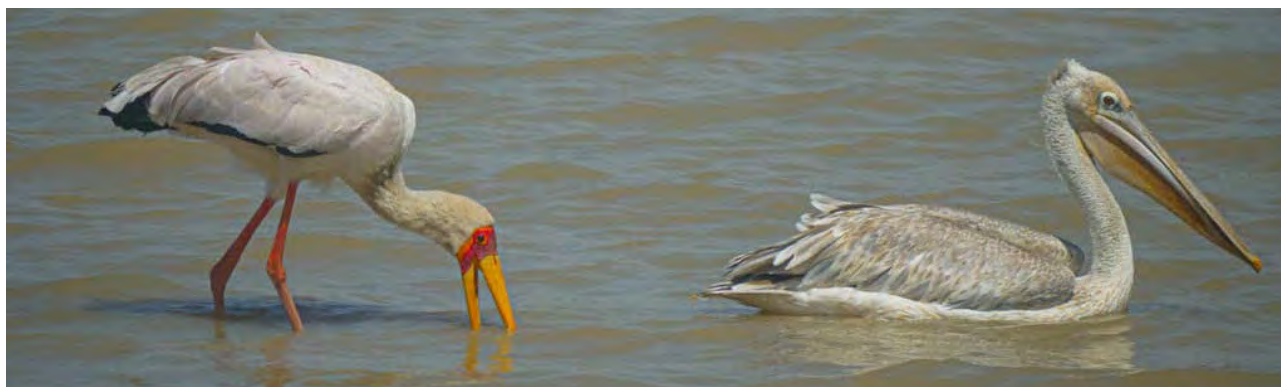
**There is poor data storage, management and accessibility** (*well established*). Poor data sharing between agencies, manual and patchy storage systems, and limited data analysis expertise are some of the main challenges. Large volumes of environmental data remain in paper files, Excel sheets, or siloed systems. Metadata is incomplete,

databases are outdated, and open-data portals are limited. This reduces transparency and slows decision-making. The contributing factors include inadequate funding, lack of human and infrastructural capacity, and poor data integration and storage practices. {8.3.2; 8.3.3}

**Institutional capacity for data management is fragmented** (*well established*). Environmental data is collected by many ministries, departments, and projects; often using different methods, formats, measurement, and reporting standards. There is no central, interoperable system for sharing data, which creates duplication, inconsistencies, and gaps in national reporting. Lack of clear quality-control procedures means that datasets are often not robust enough for policy decisions, Environmental Impact Assessments, or national reporting (e.g., for Sustainable Development Goals, Nationally Determined Contributions). The data is usually restricted and not open access. {8.3}

**There is lack of investment in statistical capacity and satellite data management** (*well established*). There is insufficient investment in data infrastructure, statistical literacy, and capacity building for data producers and users. Environmental monitoring equipment is costly. Funding is irregular and heavily dependent on donor projects, leading to unsustainable systems once projects end. Adoption of modern technologies such as automated sensors, satellite tools, and real-time dashboards is limited. Government agencies lack sufficient specialists in environmental statistics, Geographical Information Systems, remote sensing, data science, and equipment maintenance. This weakens data analysis, interpretation, and use in planning and budgeting. {8.3.3}

**Policy reforms should include resource and capacity mobilisation to support standardised data collection, digitisation, data integration, coordination, research, and awareness on key laws and policies and capacity building** (*well established*). Malawi's policy reforms should highlight the urgent need for updated and accessible data systems to counteract fragmented, outdated, or inaccessible information. {8.1, 8.3, 8.5}



The larger and more charismatic species are researched on more than smaller species such as bacteria and fungi. Photo: MEPA

## 8.0 Introduction

Current and up-to-date datasets are important for productive decisions and economic development. The term 'data' in this chapter means units of information observed, collected, or created during research. Examples of data are social science statistical and ethnographic data, humanities texts, or any other data used or produced in the course of academic research, whether it takes the form of text, numbers, image, audio, video, models, analytic code or some yet-to-be-identified data type (Imbuga 2015). Without such data, policy making is generally challenging. In Malawi, integrated environmental assessment approaches have partly strengthened the accessibility of reliable environmental data and information for improved data driven decisions and policy making at different levels. Despite the availability of considerable information and data on the state and trends of the global environment, there is still a lack of adequate and relevant data (Matchaya 2023). There is a need to constantly improve Malawi's environmental data and effectively share it for the common good.

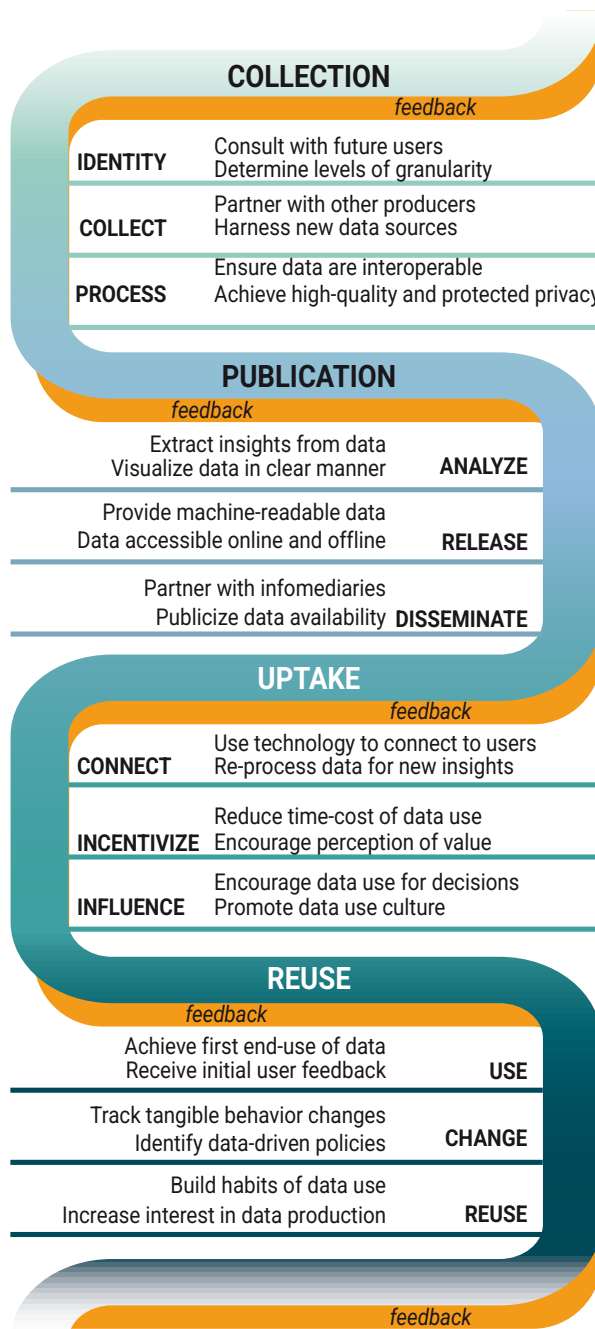
In some cases, environmental information and data exist in scientific papers and grey literature (NSEOR 2010). However, such data is scattered and not present in a format most appropriate to the users. Additionally, lack of human and infrastructure capacity to manage the data minimises availability and accessibility of productive environmental data in Malawi. Well updated data is instrumental for inclusive and effective environmental governance and development.

There is a need for a good bond and connection between data production and data use in the environmental data management system (Figure 8.1). The data collection; which further consists of data identification, collection, and processing; should feed well into the data production stage that constitutes analysis and dissemination of data. This, in turn, should be a baseline prerequisite for environmental data uptake, which mainly consists of connection and influence of such data on society. Data uptake should lead to data use and its impact. The claimed impact of data should specifically bring about productive changes at society level but also reuse of the available data for the general public (Open Data Watch 2018).



Research is key to data collection. Photo: MEPA

## Expected environmental data management system



Studio ATLANTIS, 2025

**Figure 8.1:** Expected environmental data management system as adapted from Open Data Watch (2018)

### 8.1 Missing data and the data we need

Different users need environmental data at different levels of aggregation and depths of information (FDES 2013). However, some data is missing. Missing data refers to values that are not stored or available for a variable in an observation within a dataset. Formally, it denotes the absence of data points that are conceptually meaningful for analysis but were not recorded, observed,

or collected (Little and Rubin 2017). Data users may need cross-cutting environmental statistical data sets, for instance, on climate change. In other cases, environmental data users may be interested only in particular topics and themes pertaining to specific sectoral analysis and policy making. For example, the International Monetary Fund may require a wide range of climate change data, including Greenhouse Gas (GHG) Emissions; Climate Mitigation; Climate Adaptation;

Transition to a Low-Carbon Economy; Climate Finance; and Climate and Weather. Similarly, in Disaster Risk Management, exposure data and risk extent per type

of disaster may be necessary depending on the user. Table 8.1 highlights some of the data needed across different institutions by thematic areas.

**Table 8.1:** Some data needs across thematic areas

Institution	Data Type
National Statistics Office	<ul style="list-style-type: none"> <li>• Natural resources and climate data</li> <li>• Gender and environment data</li> <li>• Population distribution data</li> <li>• Population growth data</li> </ul>
Ministry of Lands, Housing, and Urban Development	<ul style="list-style-type: none"> <li>• Population and urbanisation data</li> <li>• Land legal frameworks</li> <li>• Land degradation rate</li> <li>• Soil types and qualities</li> <li>• Land use data</li> <li>• Utility data (electricity and water)</li> </ul>
Department of Disaster Management Affairs	<ul style="list-style-type: none"> <li>• Disaster impact and emergencies</li> <li>• Extreme events, e.g., floods, drought</li> <li>• Population data</li> </ul>
Department of Economic Planning and Development	<ul style="list-style-type: none"> <li>• Poverty trends</li> <li>• Fertiliser imports</li> <li>• GDP</li> <li>• Inflation figures</li> <li>• Interest rates</li> <li>• Fiscal deficit</li> <li>• Exchange rates</li> </ul>
Department of Forestry	<ul style="list-style-type: none"> <li>• Land use, land cover</li> <li>• Forest cover changes for the past 10 years, density and location</li> <li>• Tree species</li> <li>• Deforestation rates</li> <li>• Forest degradation</li> <li>• Protected areas</li> <li>• Forest restoration efforts</li> </ul>
Ministry of Energy	<ul style="list-style-type: none"> <li>• National electricity grid data</li> <li>• Mining sites and volumes produced</li> <li>• Clean energy use (gas, electricity)</li> <li>• Solar powered households/institutions</li> </ul>
Department of Water Resources/ National Water Resources Authority	<ul style="list-style-type: none"> <li>• Major reservoirs in Malawi</li> <li>• Water quality and quantity of all major water bodies</li> <li>• Historical trends in Lake Malawi water levels</li> <li>• Groundwater yield data in all 17 Water Resources Welfare Associations</li> <li>• Irrigation water demand data</li> <li>• Abstraction of groundwater data per catchment</li> <li>• Existing water harvesting structures</li> </ul>

Institution	Data Type
Department of Fisheries	<ul style="list-style-type: none"> <li>• Fish species</li> <li>• Fish catches</li> <li>• Fishing gear types</li> <li>• Water sources for fish farming</li> <li>• Distribution of fishponds in Malawi</li> </ul>
Department of National Parks and Wildlife	<ul style="list-style-type: none"> <li>• Number of national parks and game reserves by area coverage</li> <li>• Wildlife categories by parks</li> <li>• Wildlife by age and sex categories</li> <li>• Annual populations report on wildlife</li> </ul>

To meet environmental data needs in Malawi, deliberate efforts should be placed on production of up-to-date environmental data from multiple data sources. This includes statistical surveys like censuses or sample surveys of population and housing, agriculture, enterprises, employment, and other different administrative data sources. Administrative records of government and non-government agencies responsible for natural resources; as well as other Ministries and agencies; remote sensing and thematic mapping like satellite imaging and mapping of land use and land cover, water bodies, or forest cover; monitoring systems like field-monitoring stations for water quality, air pollution, or climate; scientific research; and special projects undertaken to fulfil domestic or international demand are also sorely needed.

Malawi has substantial volumes of unpublished environmental data. For example, in public and private universities, students' dissertations, theses, and reports from field trips remain unpublished. Such data may be categorised as missing from the entire public community. The problem of missing data is not only associated with records kept in hard copies that can hardly be accessed by many, but also the non-generated data. For instance, there was a need for data on concentrations of specific air pollutants in Malawi when developing Chapter 6 (Air and climate) of this report. However, such data could not be realised since it was not generated for Malawi as of 2024. Updated land use and land cover data were missing or unavailable when developing Chapter 3 (Land and soil) of this report. Based on this, deliberate efforts need to be taken to allow for open access. Malawi must raise awareness on the importance of open access to environmental data, develop institutional data repositories, and use bibliometrics and quality indicators for due diligence checking.

## 8.2 Data availability, accessibility, and clarity

Like most African countries, Malawi is not spared the issues on data availability and accessibility challenges (UNEP 2016). Various government Ministries, Departments, and Agencies generate and manage environmental data from surveys and projects despite limited funding. All this is done to make environmental

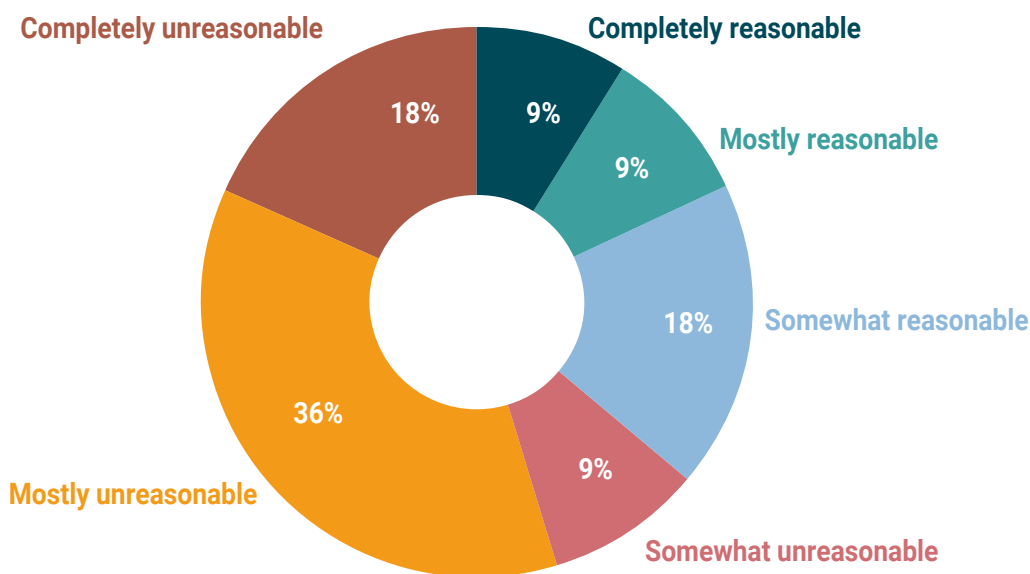
data available to users. In some instances, the data is available but in scattered, undigitised, unharmonised, and fragmented forms. For example, the Department of Climate Change and Meteorological Services has collected data on weather, climate, and agri-meteorology since 1898. A lot of the department's climate information is available for free, with some posted on their [official website](#) or [interactive map-room](#). Nevertheless, a substantial portion of the data across sources remains in undigitised format, making it difficult for users to access and utilise it.

The Department of Forestry collects and manages data on forest land cover, landscape restoration, and carbon uptake. The data is usually posted on the department's official website. Additionally, the Ministry of Water and Sanitation collects data on floods and droughts prevalence, water quality, and water quantity of major water sources. Also, academic institutions such as Malawi University of Science and Technology (MUST), Lilongwe University of Agriculture and Natural Resources (LUANAR), Malawi University of Business and Applied Sciences (MUBAS), and Mzuzu University (MZUNI) collect environmental data on biodiversity, land, water, and air for academic purposes and other environmental projects. But most of these datasets are not digitised and some are restricted for internal use, thus undermining chances of availability and accessibility.

Currently, the National Statistics Office and other Ministries, Departments, and Agencies collect and utilise environmental data across different thematic areas, including freshwater, soil, land, biodiversity, air, weather and climate (Table 8.1). However, some of the available datasets are incomplete, disintegrated, inaccurate, and lacking in international and global data standards. Consolidated national data for some sectors is missing and, in some instances, there are some area-specific datasets that conflict with others. For instance, when developing Chapter 2 of this report, it was noted that some areas had conflicting land use datasets within the same space of time. Data unavailability may be attributed to the non-generation of such data, and use of poorly standardised methodologies when collecting and managing the data. It is therefore imperative that different methodologies used in data generation are harmonised and standardised to realise minimum error

margins. Additionally, lack of collaboration among data producers may result in duplication of efforts but also use of different concepts and definitions, units, and classification. These shortfalls are some of the main causes of various challenges as far as environmental data management is concerned. Much as plurality is important in data production and management, it is imperative to ensure that only standard and acceptable methodologies should be applied to allow consistency and comparability of results.

It is important to emphasise that environmental data should be available and accessible to all users with supporting complete datasets and corresponding metadata (National Statistics Office Code of practice for Official statistics 2023). However, this is not always the case, as at times the cost of accessing environmental data by the user is affordable. For example, one study presented by Data Land Report (2024) showed that over 60 per cent of surveyed capital management institutions agreed that the costs for obtaining environmental data were unreasonable (Figure 8.2).



Studio ATLANTIS, 2026

**Figure 8.2:** Survey results concerning how reasonable participants find access costs of environmental, social and governance data.

It is worth noting that other data producers do not sell their data for profit-making but rather to partly recover the cost of production. For instance, the Department of Climate Change and Meteorological Services in rare cases attaches a small fee to recover production costs.

### 8.2.1 Data sharing protocols

Malawi needs to minimise unfriendly and non-flexible legal data frameworks to enable open access and sharing of data (open data) among the research community, policy makers, and the public as one way of improving the data management system in the country. Legal data frameworks relate to structured systems of laws, regulations, standards, and governance mechanisms that define how data should be collected, processed, stored, shared, protected, and used within a specific jurisdiction or context. Open data is conceptualised as the use of data available for use, reuse, re-purposing and redistribution by anyone to support socio-economic development interventions. The open data initiative needs to effectively consider the well-established data sharing legal frameworks. The proposed legal frameworks on

data sharing need to consider copyright, contracts, and confidentiality laws. Other relevant legislation impacting research data deal with privacy, cost, and freedom of information.

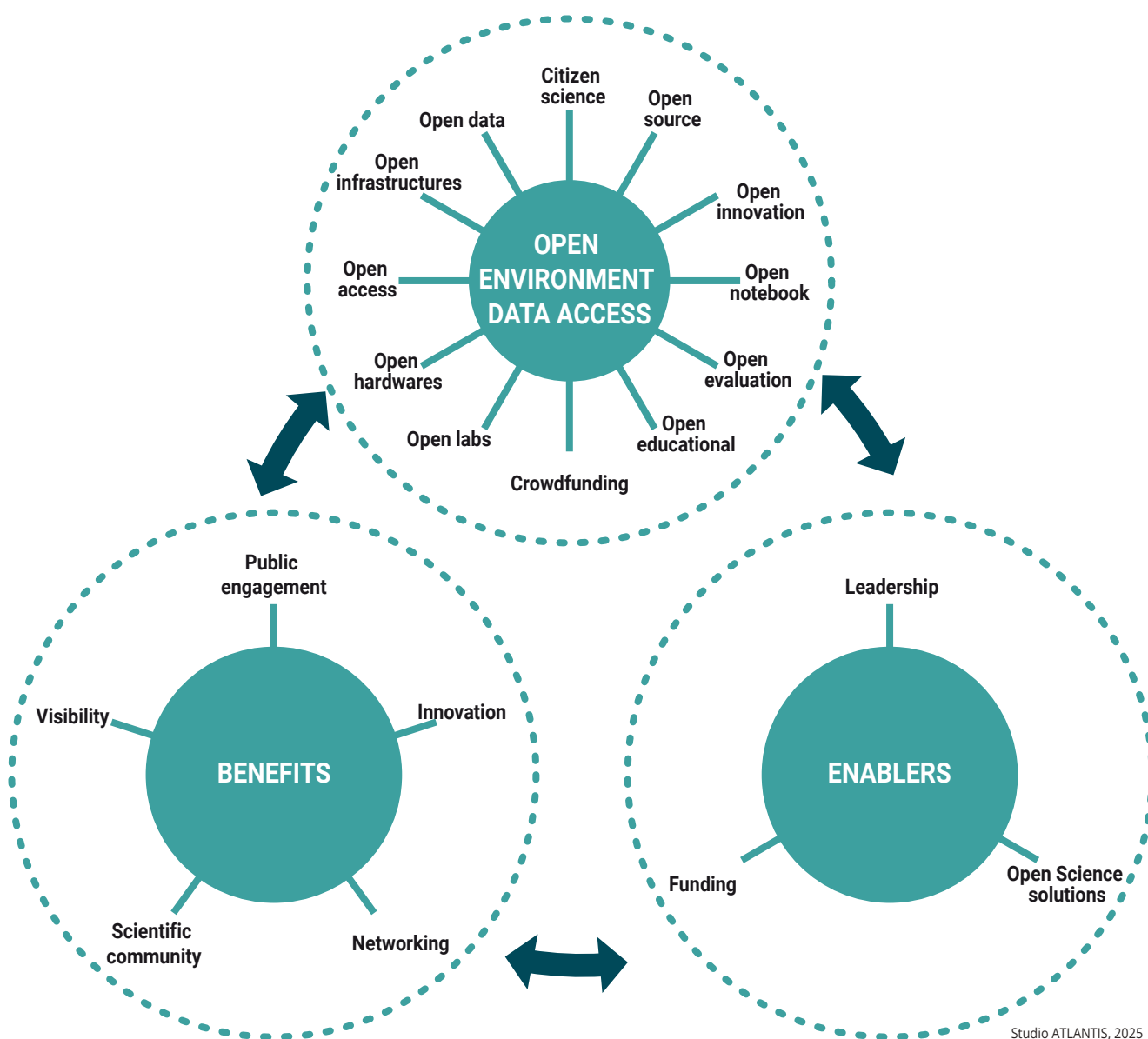
Open data access needs to include regulations on sharing, storage, and management of data sources while protecting the privacy of citizens (Mo Ibrahim Foundation 2021; Dinku 2019). In countries where these frameworks already exist, like Kenya and Rwanda, their implementation and application are closely monitored, and any abuses are easily sanctioned (OECD 2023). In such countries, stakeholders from across the private and public sectors are able to collectively monitor and respond to critical vulnerabilities related to environmental changes, using information drawn from such open data platforms (Grinspan and Worker 2020; United Nations Statistics Division (UNSD) 2023).

In this context, Malawi needs to intensify stakeholder engagement on data sharing for data producers and users to share notes and improve environmental data management. In line with the proposed data sharing legal

framework, it would be beneficial if Malawi could have a one stop-shop for environmental data. This may be managed at a centralised platform, such as the National Statistics Office, that would be aggregating data from Ministries, Departments, and Agencies, and allow data users such as researchers and policymakers access. The data produced would be in line with the internationally agreed standards to ably monitor the country's current national development plan and long-term development blueprint, the Malawi Agenda 2063. The National Statistics Office website would have a section where data users can openly access environmental data links across government and private institutions. On this platform, data producers would be able to share data either for free or at a fee depending on the one who funded the data production. For instance, if the data was funded by Malawi Government or any donor (for public consumption) the data would be shared for free, while if privately produced it would be shared at a cost, with all the details and links

shared on the platform. The proposed sharing platform would have complete datasets, not only metadata as has been the case in most data sharing platforms. Complete datasets would be openly shared and accessed for further analysis by the user or consumer.

The suggested one-stop shop data centre at the National Statistics Office would not only improve access to environmental data but would also improve timeliness in data sharing. For Malawi to fully enjoy the benefits of open environmental data, there is a need for total commitment by government institutions to generate and share environmental data openly. If government institutions would willingly allow access to data prioritisation, funding for environmental initiatives could be improved. This would surely lead to improved and productive environmental data management system in the country. Figure 8.3 represents an open environmental data system and its benefits.



Studio ATLANTIS, 2025

**Figure 8.3:** Representative contribution of government leadership in facilitating realisation of open-environmental data

## 8.2.2 Data format

Malawi's environmental data is usually presented and publicised in unharmonised formats. There is a significant lack of official, standardised, and unified data presentation formats which need to be adhered to by all environmental data producers. This becomes a challenge when harmonising such data from different data sources.

To promote proper data presentation across all players, there is need to strengthen collaboration among data users and producers such as researchers, librarians, funders, and publishers to agree on effective data management practices and data storage formats. Such practices would promote data sharing, accessibility, interoperability and reproducibility. Additionally, harmonised data formats enhance research integrity and efficiency. Efforts should also be made to use existing international standards for geospatial metadata that provides a framework for describing geographic information and services. For example, adopting ISO 19115 would promote interoperability, data discovery and data management and long-term usability.

## 8.2.3 User capacity

User statistical capacity is the ability of a country's national statistical system, its organisations, and individuals to collect, produce, analyse and disseminate high quality and reliable statistics and data to meet users' demands. User statistical capacity allows policymakers to understand, reason, and engage critically with data (M Ibrahim Foundation 2021).

There is a strong correlation between user statistical capacity and good governance, implying that countries that produce high-quality statistics tend to perform better in delivering public goods and services to their citizens. Malawi must consider strategies of improving both institutional, as well as individual user, capacities for effective decision making and policy formulation. At an institutional level, efforts should be focused on improving both technical and infrastructure development. For example, institutional data infrastructure, policies, and resources (software, equipment), as well as individual capacity development, may require a well-organised training programme to improve skills and knowledge in data analysis, statistical skills, and data management. Capacities in environmental data management need to be strengthened across the data value chains, from production, prioritisation, and management to analysis, interpretation, and use. Malawi should implement both short-term and long-term initiatives to build data user capacity. In the short term, there is a need to offer regular and brief training sessions or lessons on data usage. In the

long term, developing infrastructure such as data storage, management information systems, and establishing ongoing, in-depth training programmes is needed.

## 8.3 Data quality

Environmental data quality can mainly be improved by conducting regular training in data generation for both data collectors and managers, but more importantly, by making guidelines for ensuring data quality at all levels, mentoring programmes, and the use of Quality Assurance Frameworks (QAF) available to all.

### 8.3.1 Methodology

Quality environmental data is a product of observing international standards, guidelines, and good practices in the processes of collecting, organising, processing, disseminating, and communicating official statistics. The credibility of statistical data and information is enhanced by a reputation for good management and efficiency. This requires adequate tools, procedures and expertise. Data quality is compromised due to unsound collection tools. For instance, lack of software for production of spatial maps may result in products where facts are misinterpreted. Additionally, procedures, application of standard concepts, definitions, and classifications must be in place for consistent production of environment statistics indicators.

### 8.3.2 Accuracy and timeliness

Data accuracy refers to statistical outputs which are correct in all details and reliable to users (UNSD 2018). The following aspects of data quality should be undertaken:

- Conduct data quality assessments to validate data quality.
- Develop a release calendar and ensure its adherence in order to promote data access and availability. In this regard, environmental data producers need to stick to their dissemination time schedules as they fit well with the highest official and international dissemination standards.
- Track the indicators over time and update the indicators accordingly while aligning the processes with code of practice.
- Compare data with existing data from other sources. The comparison should focus on the methodologies used, scope, and the instruments for collecting data, as well as concepts and definitions to allow comparability across geographical layers.

**Table 8.2:** Key elements for comparability

Type of Comparability	Key Elements
Data comparability	<ul style="list-style-type: none"> <li>• Data collection methods or frequencies</li> <li>• Availability of time series data</li> <li>• Reporting periods (annual, biennial)</li> <li>• Availability of historical data for trend analysis</li> </ul>
Spatial comparability	<ul style="list-style-type: none"> <li>• Scope in terms of geographic scales (national, regional, local)</li> <li>• Variations in spatial resolution for geo data (grid size, resolution)</li> </ul>
Methodological comparability	<ul style="list-style-type: none"> <li>• Data collection methods (surveys, monitoring stations)</li> <li>• Data processing or analysis techniques</li> <li>• Data quality control or assurance tools</li> <li>• Classification or categorisation systems</li> </ul>
Unit of measurement comparability	<ul style="list-style-type: none"> <li>• Unit of measurements used (metric vs non-standard units)</li> <li>• Conversion factors or scaling where non-standard units are used</li> <li>• Data normalisation or standardisation</li> </ul>
Semantic comparability	<ul style="list-style-type: none"> <li>• Definitions or interpretations of indicators</li> <li>• Terminology or vocabulary</li> <li>• Data categorisation or classification</li> </ul>
Data source comparability	<ul style="list-style-type: none"> <li>• Different data sources (government, NGOs, research institutions)</li> <li>• Variations in data collection or reporting protocols</li> <li>• Data validation or verification</li> </ul>
Procedure for assessment of data comparability	<ul style="list-style-type: none"> <li>• Check whether standardised data collection and reporting protocols are followed</li> <li>• Review methodologies and units of measurement if they are consistent with the standards</li> <li>• Check existence of data quality controls and quality assurance (eg Malawi Quality Assurance Framework)</li> <li>• Check whether metadata and documentation of data is practiced among the institutions</li> <li>• On missing data, check whether harmonisation techniques (interpolation, extrapolation) are done</li> <li>• Check whether regular data reviews and updates are done by the institutions on their data</li> <li>• Check whether there are engagements between international cooperation and the relevant institutions in promoting data sharing</li> </ul>

### 8.3.3 Data inconsistency

Statistical outputs from the same source or different sources and periodicity must be logical and consistent.

One should be able to compare and reconcile these statistics. Statistical data and information must be internally coherent and consistent. Environmental statistics producers should therefore develop, produce,

and disseminate statistics that are consistent, meaning it should be possible to combine and make joint use of related data, including data from different sources. Data consistency is also achieved when the statistical data and information are compiled and produced using a similar Compendium of Statistical Concepts and Definitions. The use of inconsistent data highly compromises data comparability.

## 8.4 Financial constraints

There is poor or lack of funding to tackle the available environmental data challenges in Malawi. This may partly be due to lack of prioritisation of environmental initiatives and activities. The insufficient investment in environmental infrastructure impedes the effective generation, operation, and maintenance of environmental data observation networks and their related infrastructure (Matchaya *et al.* 2023; Dinku 2019). Despite the nation's readiness to have a neutral, public, and transparent data platform that should offer raw data, poor funding deters this realisation. Sufficient funding is needed for the development and enhancement of innovative tools, methodologies, and platforms that aim to significantly improve the quality, detail, and reliability of environmental data. In Malawi, due to poor funding, researchers are forced to use low-cost methodologies and analytical strategies that may have large error margins. This further negatively affects data quality, reliability, and comparability. In addition to this, insufficient funding in research studies minimises chances of getting publications in active journal platforms. This in turn reduces access to the already limited data.

## 8.5 Recommendations and conclusions

Based on the lessons learnt from this chapter, the following recommendations have been drawn and categorised into short-term, medium-term, and long term, but also stakeholder engagement.

### 8.5.1 Short-term recommendations

- **Conduct rapid assessments to identify urgent data gaps and prioritise areas for immediate attention.** Environmental Indicators Self-Assessment Tool and Climate Change Indicators Self-Assessment Tools should be used annually. Understanding the Framework for the Development of Environment Statistics is critical in this regard.
- **Leverage existing data sources.** There is a need to identify and leverage existing data sources, such as administrative records, surveys, or remote sensing data.
- **Implement citizen-generated data initiatives.** Launch citizen-generated data initiatives, such as crowdsourcing or mobile apps, to collect data on specific topics.

- **Establish data partnerships.** Promote partnerships with other organisations, such as government agencies, non-governmental organisations, or private companies, to share data and expertise.
- **Develop and disseminate data standards.** Develop and disseminate data standards, such as data dictionaries or metadata standards, to ensure data consistency and quality.
- **Provide training and capacity building.** Provide training and capacity building for data collectors, analysts, and users to ensure they have the necessary skills to collect, analyse, and use data competently.
- **Use data quality assurance frameworks.** Use the available data quality assurance frameworks to ensure data accuracy, completeness, and reliability. Proposed harmonised methodologies and shared metadata standards would mitigate data inconsistencies.
- **Establish a data governance structure.** Establish a data governance structure to oversee data management, ensure data security, and promote data sharing. This process involves a diagnostic study to map and eliminate bureaucratic bottlenecks in data access and to develop guidelines for automatic data-sharing agreements.
- **Develop a national environmental data strategy.** There is a need to develop a comprehensive national data strategy for environment to guide data management, analysis, and dissemination efforts.

### 8.5.2 Medium-term recommendations

- **Implement a citizen-generated data platform.** Develop and launch a citizen-generated data platform to collect and analyse data from citizens.
- **Develop a geospatial data infrastructure.** Develop a geospatial data infrastructure to support the collection, analysis, and dissemination of geospatial data.
- **Establish a data dissemination platform.** Develop and launch a data dissemination platform to share data with stakeholders and the public.
- **Enhance data analysis and visualisation capabilities.** Enhance data analysis and visualisation capabilities to support evidence-based decision-making.

### 8.5.3 Long-term recommendations

- **Invest in data infrastructure.** There is a need to invest in data infrastructure across the nation, including data centres, cloud storage, and data analytics platforms.

- **Develop a data governance framework.** Develop a data governance framework to ensure data quality, security, and compliance with regulations. Data needs to be collected, quality-assured, and quality-checked on a wide set of topics. Multi-stakeholder consultations to draft a legal framework tailored to Malawi's needs on environment data would be ideal.
- **Establish a data sharing agreement framework.** To promote data sharing, there is a need to establish a data sharing agreement framework. There should be a proposed component of a standardised data format framework. In this case, we will have uniform data structure for sharing environmental data
- **Establish one-stop data shops.** Design and implement a national one-stop data shop and manage data from various sources. This centralised platform or portal will provide seamless access to various data sources, tools, and services.
- **Stakeholder engagement is needed to advocate for evidence-based decision-making on environmental issues.** Stakeholders should work together and pull in one direction. Government agencies, the private sector, civil society organisations, academia and research institutions, and development partners must work in collaboration to ensure that Malawi has official statistics on environment data available in one place.



There are various forms of data, including statistics, aerial photography and satellite imagery. Photo: Horst Vogel.

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Photo: Horst Vogel.



# 09 Overview of environmental policies and their effectiveness

**Coordinating Lead Authors:** Mirriam Joshua; Julius Ng'oma; and John Chipeta  
**Lead Author:** Vitumbiko Chirwa and Glory Muva

## Executive summary

**Environment and sustainable resource management in Malawi are supported by a framework comprising global, regional, and national policies, strategies, laws, and institutional structures** (*well established*). This framework plays an important role in guiding the sustainable management of the country's land, water, forests, fisheries, and biodiversity, which form the backbone of the economy and people's livelihoods. Accelerating environmental degradation, including deforestation, soil erosion, biodiversity loss, water resource depletion, pollution, and climate change threaten the environment and natural resources. These challenges have intensified during the period between 2010 and 2024, resulting in significant socio-economic and ecological consequences that undermine food security, public health, and sustainable development. For instance, the percentage of forest land in Malawi continues to decline significantly. As of 2025, forests cover approximately 21.5 per cent of Malawi's total land area, down from roughly 37 per cent in 1990, translating to an annual deforestation rate of about 2.8 per cent. In the water sector, there was an increase in access to improved drinking water sources from 74.2 per cent in 2008 to 85.4 per cent in 2018. Challenges persist in rural areas, where roughly 30 per cent of water points are frequently non-functional. {9.0}

**The Government of Malawi has undertaken several policy response measures, demonstrating its commitment to addressing global environmental challenges through active participation in the development of international and regional agreements** (*well established*). The country is signatory to key international instruments, including the United Nations Framework Convention on Climate Change, the Paris Agreement, the United Nations Convention on Biological Diversity, the United Nations Convention to Combat Desertification, the Sustainable Development Goals (SDGs), the Ramsar Convention on Wetlands, and the Sendai Framework for Disaster Risk Reduction. At the regional level, Malawi is a member of the African Union and the Southern African Development Community, reflecting its commitment to the respective environmental and sustainable development strategies, such as Africa's Agenda 2063, the African Union Climate Change and Resilient Development Strategy and Action Plan (2022–2032), and the SADC Climate Change Strategy and Action Plan (2015). {9.1, 9.4}

**The foundation for environmental protection and sustainable resource use in Malawi is laid out in the Constitution and a comprehensive suite of national policies, strategies, and laws** (*well established*). The Constitution of the Republic of Malawi stipulates the right to a clean and healthy environment, providing the bedrock for environmental governance. Key national-level instruments, such as the Environment Management Act, the Water Resources Act, the Forest Act, the Land Act, the Wildlife Act and the Disaster Risk Management Act, offer a robust legal framework for safeguarding the environment,

sustainable utilisation of resources, and mitigation of disaster risks. Additionally, national policies such as the National Environmental Policy, the National Climate Change Management Policy, the National Land Resources Management Policy, and the National Water Policy guide practices as far as sustainable environment management and resources use is concerned. {9.1, 9.6, 9.9}

**Malawi's Policy, Legal, and Institutional Framework addresses critical environmental domains namely land, water, air, and biodiversity with the objectives of improving resilience, promoting sustainable resource use, and fostering inclusive governance** (*well established*).

Despite significant progress in policy, legal, and institutional development and reforms, implementation challenges persist. These include weak enforcement mechanisms, limited financial and human resources, fragmented institutional mandates, and insufficient integration of environmental considerations across sectors. Nonetheless, progress has been recorded in areas such as forest co-management, community-based natural resource management, and improved policy coherence, including alignment with the SDGs and international environmental treaties. Notable examples include the 2017 launch of the National Charcoal Strategy, which seeks to reduce unsustainable wood fuel dependence through improved cook stove distribution and alternative energy sources. Malawi also pledged to restore 4.5 million hectares of forest under the Bonn challenge and subsequently developed the National Forest landscape Restoration Strategy to operationalise this commitment. Establishment of the National Water Resources Authority through the Water Resources Act of 2013 and implementation of the Second National Water Development Project have also enhanced water governance and extended access to piped water services. {9.1, 9.6, 9.9}

**Gaps remain in stakeholder engagement, equitable access to land, enforcement of environmental safeguards, data availability, and policy coherence** (*well established*). The grouping of biodiversity into four major economic sectors, namely forestry, fisheries, wildlife, and agriculture result in policy silos as well as the exclusion of microorganisms and microbes. While the National Resilience Strategy and the National Climate Change Management Policy are conceptually sound, their practical impact is constrained by inadequate resources and coordination challenges at both national and local levels. The integration of Indigenous and Local Knowledge into environmental governance remains limited and underutilised. Although some policies recognise community participation, few formally acknowledge Indigenous and Local Knowledge as a vital tool for environmental and natural resources management, climate adaptation, and sustainable resource management. This represents a missed opportunity to leverage locally grounded approaches to sustainability. {9.4, 9.8, 9.11}

**Improving the effectiveness of environmental policies in Malawi requires a coordinated and holistic approach** (*well established*). This includes strengthening institutional and technical capacity particularly at the subnational level, ensuring sustained and equitable financing, improving

cross-sectoral coordination and policy coherence, and fostering inclusive stakeholder engagement, with a strong emphasis on the participation of marginalised groups and the integration of Indigenous and Local Knowledge. {9.1, 9.3, 9.5, 9.8.1, 9.11}



Effective policy implementation is driven by locals. Photo: Horst Vogel

## 9.0 Introduction

Malawi is endowed with rich biodiversity and abundant natural resources. In the face of accelerating environmental change and worsening environmental sustainability challenges, robust environmental governance is more critical. Malawi has articulated its development vision through several national priorities focusing on sustainable economic growth, poverty reduction, food and energy security, and the preservation of its natural heritage. Achieving these goals requires sound environmental policies, legal and institutional frameworks, and most importantly, effective implementation.

The Constitution of Malawi serves as the normative foundation for environmental governance by recognising the right to a clean and healthy environment and obliging the State and citizens to protect natural resources for present and future generations. This constitutional mandate is implemented through a range of national policies, laws, institutions, and regulatory instruments governing land, water, forests, biodiversity, air, climate change, and energy. Together, these frameworks establish environmental sustainability as a prerequisite for inclusive economic growth, poverty reduction, food and energy security, and resilience to climate shocks. Malawi has deliberately positioned environmental protection and sustainable resource management as central enablers of development, rather than as constraints to growth as highlighted in Malawi Agenda 2063. Implementation is further supported through decentralised governance arrangements, environmental safeguards such as environmental and social impact assessments, and the Malawi 2063 Implementation Plans (MIPs), which mainstream environmental considerations across

productive and social sectors including agriculture, energy, infrastructure, and urban development.

At regional and global levels, Malawi is a signatory to key Multilateral Environmental Agreements (MEAs) and regional agreements and protocols, such as the United Nations Framework Convention on Climate Change (UNFCCC), the RAMSAR Convention on Wetlands, the African Union Agenda 2063, the Sustainable Development Goals (SDGs), the Energy Compact, and Southern African Development Community (SADC). These commitments reflect Malawi's pledge to uphold environmental responsibility, advance universal energy access, and pursue a path toward net-zero emissions. To guide national action and support these obligations, Malawi has developed several policies, institutional and legal frameworks to sustainably manage land, air, water and biodiversity resources. The domestication of these regional and global commitments has significantly shaped Malawi's environmental policy landscape, aligning national development priorities with internationally agreed environmental sustainability principles.

### 9.1 Global policy, legal, and institutional frameworks

The Government of Malawi is party to several multilateral environmental agreements (MEAs). These include the United Nations Framework Convention on Climate Change, the Paris Agreement, SDGs, Sendai Framework for Disaster Risk, United Nations Convention on Biological Diversity, the United Nations Convention to Combat Desertification, and the Ramsar Convention on wetlands. **Table 9.1** provides an overview of global MEAs to which Malawi is party to, including their domestication and implementation.



Charcoal production and use cause damage to the environment despite the existence of the Malawi National Charcoal Strategy (2017). Photo: Marisol Soledad Estrella.

**Table 9.1:** Global policy, legal, and institutional frameworks

Policy/legal framework	Environmental Issue Addressed	Rationale and Key Features
United Nations Framework Convention on Climate Change (UNFCCC) (1994)	Climate change Air pollution Greenhouse gas emissions Climate related hazards, risks and disasters	UNFCCC aims at preventing “dangerous” human interference with the climate system. Over the years, negotiations under the UNFCCC have resulted in agreements to advance the goal of limiting global warming through the Kyoto Protocol and the Paris Agreement. As a party to the UNFCCC, Malawi has put in place a series of legislative frameworks and strategies to integrate environment and climate change management in socio-economic development activities that contribute to addressing climate change. These include the Nationally Determined Contributions (NDCs), National Adaptation Programmes of Actions (NAPA), Nationally Appropriate Mitigation Actions (NAMA), and National Communications and Biannual Communications. The National Communication and First Biennial Transparency Report indicates progress related to strengthened institutional arrangements, and mainstreaming of climate action into development planning.
Sustainable Development Goals (SDGs) (2015)	Poverty Environmental degradation Sustainable natural resources use and management	These are a set of 17 goals and 169 targets that aim to end poverty, protect the planet, and ensure peace and prosperity for all by 2030. The SDGs address various aspects of environment and natural resources management including issues of food security, water management, health, education, infrastructure, biodiversity, and justice. The SDGs also call for integrated approaches that consider the interconnections and trade-offs between different goals and targets. Malawi has developed strategies, through the existing natural resources and environment policies, to implement the SDGs and achieve various set targets. The SDGs have been mainstreamed into national development planning through the third Malawi Growth and Development Strategy (MGDS III). All SDGs were aligned with national priorities, sector policies, district plans, and the national budget. Monitoring, evaluation, and reporting mechanisms were established along with regular quarterly and annual reviews by Sector and Technical Working Groups, and these are coordinated by the National Planning Commission in collaboration with support from the Ministry of Finance. Progress has been uneven due to climate shocks, rising poverty levels, and capacity constraints.
The Paris Agreement (2015)	Climate change Air pollution Greenhouse gas emissions	The Paris Agreement aims to combat global warming by limiting the rise in average global temperatures to well below 2°C above pre-industrial levels, with an aspirational target of limiting the increase to 1.5°C. Article 7(7a) of the Paris Agreement calls for parties to collaborate in bolstering adaptation efforts, with a particular emphasis on strengthening scientific knowledge related to climate change. This includes advancing research initiatives, implementing systematic observation of the climate system, and enhancing early warning systems. By prioritising these actions, Parties aim to deepen their understanding of the evolving climate dynamics and associated risks, thereby facilitating the provision of accurate and timely climate services. These efforts are essential for supporting informed decision-making processes at all levels, from local to global, and to effectively address the impacts of climate change on vulnerable communities and ecosystems. Malawi developed strategies to domesticate the Paris Agreement through implementation of adaptation and mitigation interventions and reporting on progress as part of the country’s Nationally Determined Contributions.

Policy/legal framework	Environmental Issue Addressed	Rationale and Key Features
The Sendai Framework for Disaster Risk Reduction (2015-2030)	Increased frequency and intensity environmental risks and disasters	The framework aims to prevent new and reduce existing disaster risks and strengthen resilience to disasters. The framework sets four priorities for action: understanding disaster risk, strengthening governance, investing in risk reduction, and enhancing preparedness and recovery. The framework also recognises the linkages between disaster risk reduction and climate change adaptation and calls for coherence and coordination between the two agendas. In line with the frameworks' priorities, Malawi has made progress in terms of mainstreaming disaster risk reduction into national and local development planning, strengthening governance frameworks, expanding early warning systems, and investing in resilience-building interventions. The efforts are supported by the domestication of the framework in key strategies such as the National Disaster Risk Management Policy, Disaster Risk Financing Strategy, National Resilience Strategy, and National Disaster Risk Management Act.
United Nations Convention on Biological Diversity (1992)	Loss of biodiversity Environmental degradation Sustainable natural resources use and management	The convention is responsible for the conservation of biological diversity around the world. The goals of the convention are to conserve biological diversity, support the sustainable use of components of biodiversity, and fair and equitable sharing of benefits arising from genetic resources. The idea of the convention is to develop national strategies for conservation and sustainable use of biological diversity. The agreement covers aspects of conservation of all genetic resources, species and ecosystems. The treaty also covers traditional conservation efforts through linkages to the economic goal of using biological resource sustainably. The convention covers the rapidly expanding field of biotechnology through its Cartagena Protocol on Biosafety, addressing technology development and transfer, benefit-sharing, and biosafety issues. Malawi has advanced the implementation of the CBD through its National Biodiversity Strategy and Action Plan, with progress in conservation planning and community-based natural resource management. Biodiversity has been mainstreamed into national and local policies, including Malawi Agenda 2023. Key achievements include establishing the National Biodiversity Information Facility, strengthening public-private partnerships for protected areas, and adopting initiatives such as BIOFIN to address biodiversity financing gaps.
United Nations Convention to Combat Desertification (1992)	Land degradation and desertification	The convention was set up to address desertification and the effects of drought. Based on the principles of participation, partnership, and decentralisation, the convention is a multilateral commitment to mitigate the impact of land degradation and safeguard its ability to provide food, water, shelter, and economic opportunity to all people. It helps people, communities and countries create wealth, grow economies and secure enough food, clean water and energy by ensuring land users an enabling environment for sustainable land management. Since the ratification of the convention, Malawi has shown commitment through the establishment of a national steering committee and integrating the issue of desertification into sectoral policies. An Endowment Fund was also established to support local activities.

Policy/legal framework	Environmental Issue Addressed	Rationale and Key Features
The Ramsar Convention on Wetlands (1971)	Wetlands degradation Water contamination and pollution Depletion of fish stocks	The convention highlights the importance of wetlands in regulating water systems and providing habitats for biodiversity, including the waterfowl. It advocates for the protection and sustainable use of these wetlands through both national and international cooperation, ensuring their conservation for ecological, cultural, and economic values. As of 2021, Malawi has designated two Ramsar sites: Lake Chilwa and Elephant Marsh. This initiative has raised awareness about the importance of wetlands and has improved stakeholder involvement in wetland management, as demonstrated by Community-Based Natural Resources Management (CBNRM) groups in Lake Chilwa. Domestication of this convention has been done through other sectoral policies such as Land Policy, water policy, irrigation policy, fisheries policy and forestry policy. Despite the domestication of the convention, the country still lacks dedicated wetlands policy for effective implementation



Protected areas such as national parks and Ramsar sites play host to wildlife in the country, including large populations of elephants. Photo: Helle Biseth

## 9.2 Regional policy, legal, and institutional frameworks

Malawi is party to several regional policy agreements relating to environment and natural resources management (Table 9.2). These regional instruments include the African Union Agenda 2063, the SADC

Climate Change Strategy and Action Plan (2015), and the SADC Protocol on Shared Water Resources (2000). These agreements are crucial in guiding national efforts towards the management of the environment and natural resources, addressing the impacts of climate change, promoting biodiversity conservation, and fostering sustainable economic development.

**Table 9.2:** Regional policy, legal and institutional frameworks

Policy/legal framework	Environmental Issue Addressed	Rationale and Key Features
African Union Agenda (2063)	Sustainable resource exploitation Climate vulnerability Biodiversity loss Pollution Ecosystem disruption	The agenda seeks to harness the continent's potential, address challenges, and position Africa as a key player on the global stage. It focuses on inclusion of environment and climate change into national policies and promoting social, economic, and environmental well-being.
African Union Climate Change and Resilience Development Strategy and Action Plan (2022-2032)	Infrastructure resilience Climate vulnerability Desertification	The strategy and action plan aims to build resilience to climate change impacts and to enhance adaptive capacity among member states.
African Union Biodiversity Strategy and Action Plan (ABSAP) (2023-2030)	Biodiversity loss Deforestation and habitat destruction Invasive species Pollution	The strategy is aimed at enhancing biodiversity conservation and sustainable management across the continent. It seeks to ensure that the continent's rich natural heritage is preserved for future generations while supporting sustainable livelihoods and development.
Green Economy Strategy and Action Plan for Sustainable Development (2015)	Energy efficiency Dependence on fossil fuels Waste management Sustainable land use practices Degradation of ecosystems	The plan focuses on transitioning to a green economy, promoting sustainable practices across sectors. The strategy emphasises the integration of environmental considerations into economic planning and decision-making, and ensuring that economic growth is sustainable.
SADC Climate Change Strategy and Action Plan (2015)	Frequency of extreme weather events Water scarcity and quality degradation Food security Ecosystem degradation Biodiversity loss	The strategy and action plan aim to facilitate a unified response to climate change impacts on member countries, and to enhance resilience and adaptive capacity.
SADC Vision (2050)	Deforestation and land degradation Energy security and transition Unsustainable agricultural practices Water scarcity Ecosystem services decline	The vision seeks to foster regional economic integration, poverty alleviation, and sustainable resource management. It prioritises environmental protection.
SADC Protocol on Shared Water Resources (2000)	Pollution of water sources Degradation of water ecosystem Transboundary conflicts Sustainable water management practices	The protocol promotes sustainable management of transboundary water resources.

### 9.3 Overarching policies and institutional frameworks

Malawi's environment management sector is guided by several key policies and legal frameworks, which are

both sector specific and cross-cutting. The constitution of Malawi sets the foundation for environmental management, while Malawi Agenda 2063 identifies environmental sustainability as one of the key enablers of development. The National Environmental Policy

provides overarching guidance for managing issues like deforestation, pollution, and biodiversity loss, while promoting sustainable development through an integrated and participatory approach. The Environmental Management Act strengthens this framework by establishing legal provisions for the protection and sustainable use of natural resources and guaranteeing every Malawian the right to a clean and healthy environment. Other key policies include

the National Climate Change Management Policy, the National Resilience Strategy (2018–2030), the draft National Adaptation Plan, and the Nationally Determined Contributions, which focus on climate change, disaster risk reduction, and resilience. The Decentralisation Policy supports local-level implementation. Challenges such as limited coordination, technical capacity, and funding continue to hinder effective execution. Table 9.3 provides an overview of these policies.

**Table 9.3:** Overarching policy, legal, and institutional frameworks in Malawi

Policy/legal framework	Environmental Issue Addressed	Rationale and Key Features
Constitution (1994)	Environmental degradation	The national Constitution of Malawi sets out a broad framework for sustainable environmental management at various levels. For example, section 13 (d) provides for prudent management of the environment and accords future generations their full rights to the environment. The Constitution also provides fundamental principles that require the state to promote the welfare and development of people by progressively adopting and implementing policies and legislation aimed at achieving responsible management of the environment. The constitution aspires to prevent the degradation of the environment, provide healthy living and working environment, ensure intergenerational equity through environmental protection and sustainable development of natural resources. This implies that environmental protection is a fundamental right for Malawian citizens, and the state must balance economic development with environmental protection and sustainable resource management to ensure a healthy environment for current and future generations.
Malawi Agenda 2063	Environmental degradation Sustainable development	The agenda charts the country's new development trajectory to achieve an upper-middle income status by 2063. It reflects the collective aspirations of the people of Malawi to achieve inclusive wealth creation and self-reliance for economic independence.
National Environmental Policy (2004)	Deforestation and land degradation Water pollution Biodiversity loss Climate change Pollution Waste management	The policy is an umbrella framework that guides different lead agencies and stakeholders in activities that affect the environment and natural resources management, including how to minimise impacts of environmental degradation. The policy promotes sustainable, social, and economic development through sound management of the environment and natural resources. Areas covered by the policy include integrated approaches, community participation, sustainable development, robust legal and institutional framework, capacity building, research and knowledge generation, monitoring and evaluation, energy consumption, and sustainability.
Environment Management Act (2017)	Sustainable environmental practices Protection of biodiversity Pollution Sustainable land use Climate change	The act generally provides for protection and management of the environment, conservation, and sustainable utilisation of natural resources. Section 4 (1) gives every Malawian the right to a clean and healthy environment. The EMA further provides for the creation of regulations on all aspects of environmental management, so that gaps or inconsistencies in sectoral legislation may be rectified. The act forms the main instrument for ensuring environmental, social, and economic sustainability of interventions, including infrastructure development projects.

Policy/legal framework	Environmental Issue Addressed	Rationale and Key Features
National Climate Change Management Policy (2016)	Rising temperatures, prolonged dry spells and droughts Erratic rainfall patterns Land degradation, soil erosion, and desertification, particularly in rural areas Access to productive land Food security	The policy provides a comprehensive framework for integrating climate change considerations into national development planning. The policy aims to enhance resilience to climate impacts while promoting sustainable development. A key focus is on incorporating climate change adaptation and mitigation strategies into both national and sectoral development plans, ensuring that climate resilience becomes a core part of the country's development agenda. The policy promotes sustainable agricultural practices, improved water resource management, and strengthened disaster risk reduction efforts to build resilience of communities, ecosystems, and economies. It fosters sustainable development by encouraging the use of green technologies and environmentally responsible practices to reduce greenhouse gas emissions and promote sustainable resource use.
National Resilience Strategy (2018 – 2030)	Food insecurity Increased environmental risks, hazards, shocks and disasters	The strategy explores effective approaches to breaking the cycle of food insecurity in Malawi. It introduces a new sense of common purpose to break the cycle of food insecurity by bridging development and humanitarian interventions and prioritising a continuum of more predictable livelihood support 'packages' that target vulnerable households.  The strategy is composed of four complementary pillars: resilient agricultural growth; risk reduction; flood control, and early warning and response systems; human capacity, livelihoods, and social protection and catchment protection and management. The strategy is delivered through district development plans, department partners, the private sector, and non-governmental organisations.
National Adaptation Plan Framework (2020)	Increased climate and environmental risk, hazards, shocks and disasters	The framework links policies, plans, strategies and legislation that seek to enable Malawi to address its medium and long-term adaptation needs. It identifies mandates for the national adaptation plan process and outlines stakeholder roles.
Nationally Determined Contributions (NDCs) (2021)	Increased climate and environmental risk, hazards, shocks and disasters	The NDCs embody efforts by countries that are party to the Paris Agreement to put in place measures to reduce national emissions and adapt to the impacts of climate change. They outline climate action that will be taken by the government to address climate change adaptation and mitigation from 2020 to 2040. The NDCs call for the engagement of diverse stakeholders who are implementing and monitoring climate actions. Additionally, Malawi recognises the need for significant financial and technical support from international climate finance mechanisms, donors, and the private sector to achieve these ambitious goals.
National Decentralisation Policy (2024), Vol II.	Inadequate technical and financial resources for implementation of interventions	The policy seeks to promote local governance and community-led development. While progress has been made, challenges persist in ensuring that all groups, especially marginalised communities, have an equitable voice in decision-making processes.

Policy/legal framework	Environmental Issue Addressed	Rationale and Key Features
National Urban Policy (2019)	Environmental degradation Resilience to climate shocks Unsustainable urbanisation	The central focus of the policy is to create an enabling environment for the attainment of sustainable urbanisation in Malawi. This overarching aim is driven by the recognition that Malawi is rapidly urbanising, but this growth is not matched by the capacity to provide essential services and infrastructure, leading to significant challenges. The policy focuses on transforming urbanisation from a constraint to an opportunity for national growth and development. It aims to provide a comprehensive framework to guide urban development programmes and address major challenges associated with urban development and management in Malawi.
National Population Policy (2023)	Population growth and demography Environmental degradation	The policy prioritises coordination and implementation of programmes that seek to address population and development issues at national and sub-national levels. The policy draws from preceding population policies. The goal and objectives of the National Population Policy are in line with the aspirations of Agenda 2063. The priority areas set out in the National Population Policy are also consistent with most SDGs, especially the goals on poverty, hunger, good health and wellbeing, quality education, gender equality, clean water and sanitation, and climate action.
National Gender Policy (2015)	Environmental degradation Pollution and waste management	The policy provides guidelines for addressing gender inequalities across economic sectors to promote sustainable, equitable development and reduce poverty. It prioritises key areas such as health, agriculture, food security, natural resources, the environment, and climate change. The policy ensures women and vulnerable groups have access to agricultural resources and markets, promotes gender inclusion in managing natural resources, and integrates gender considerations into poverty reduction and economic empowerment efforts, with a focus on enhancing women's participation.
Gender Equality Act (2013)	Environmental degradation	The act promotes gender equality by ensuring equal integration, influence, empowerment, dignity, and opportunities for both men and women in society. It prohibits sex discrimination, harmful practices, and sexual harassment, while raising public awareness on gender equality. Section 7(1) of the act mandates the government to ensure employers implement policies that eliminate sexual harassment in the workplace. Section 11(1) requires public service recruitment to maintain gender balance, with no less than 40 per cent and no more than 60 per cent of either sex. The act provides guidelines for gender equality in recruitment and regulates workplace behaviour for both employers and employees.

## 9.4 National policy, legal, and institutional frameworks

### 9.4.1 Overview of land policies

Land-based policies are essential for promoting sustainable land use management and improving food

security in the country. Currently, several land-based policies are in effect. Table 9.4 outlines their intended environmental impacts, as well as legal and institutional frameworks. The policies cover critical issues such as land tenure insecurity, deforestation, unsustainable land use, and soil degradation.

**Table 9.4:** An overview of land-based policy, legal, and institutional frameworks in Malawi

Policy/legal framework	Environmental Issue Addressed	Rationale and Key Features
Customary Land Act (2016)	Land tenure insecurity Land degradation	The act seeks to secure land tenure for smallholder farmers, as well as to promote sustainable land use.
National Forestry Policy (2006)	Deforestation Biodiversity loss	The policy provides a framework for sustainable production and conservation of wood resources and recognises the importance of wood fuels in the national energy supply and the need to bring about improvements in their sustainable production and supply. It promotes community-based afforestation and forest conservation.
Land Act (2016)	Unsustainable land use Land conflicts	The act guides implementation of the land policy by detailing management of land ownership, land transfer, use of land, and compensation. It classifies land into public and private categories and facilitates sustainable land management.
Greenbelt Initiative (2010)	Land degradation Soil infertility	The initiative integrates irrigation with climate-smart agricultural practices.
Forest Act Amendment (2020)	Illegal logging Deforestation	The act provides for the management of trees and forests under customary and private land, as well as in protected areas. It strengthens penalties for illegal activities and enhances forest restoration efforts.
Mines and Mineral Policy (2013)	Soil contamination Land degradation	The policy promotes sustainable mineral resource development while ensuring environmental protection and biodiversity conservation.
Agriculture Land Resources Management Policy (2024)	Unsustainable land use, Soil degradation Land tenure insecurity Deforestation	The policy guides the implementation and scaling up of sustainable land management activities to improve natural resource-based livelihoods in the country. The policy aims to reduce land degradation and promote investments by agricultural stakeholders in climate change adaptation and mitigation practices. This will be carried out in accordance with relevant policy and legal frameworks, aligned with key local, regional, and global policies.
National Fertiliser Policy (2021)	Soil degradation and pollution Harm to natural resources Inappropriate waste disposal	The fertiliser policy seeks to sustainably increase commercial supply, access to, and efficient use of high-quality fertilisers for increased agricultural production and productivity.

#### 9.4.2 Overview of water policies

Water-based policies are important for ensuring the sustainable management of water resources, as they tend to address water quality, access to safe drinking water, irrigation practices, and river basin management, among other issues. Water-based policies in Malawi promote efficient water use, protect aquatic ecosystems,

and ensure equitable access to water resources by all communities. By integrating these policies into broader environmental and development strategies, Malawi can better manage its water resources, mitigate the impacts of climate change, and support sustainable economic growth. Table 9.5 provides an overview of water-based policies in Malawi.

**Table 9.5:** Overview of water-based policy, legal, and institutional frameworks

Policy	Environmental Issue Addressed	Rationale and Key Features
Water Resources Act (2013)	Watershed degradation Water contamination and pollution Siltation	The Act promotes the rational management of the use of water resources of Malawi. It regulates all public and private activities, which may influence the quality, quantity, distribution, use, or management of water resources. The legislation regulates water resources protection, conservation and planning, and catchment management. The Act controls use of water resources, water rights and pollution of public water resources. It regulates water use, including establishing the 30-meter buffer zones around water bodies to curb encroachment.
National Water Resources Policy (2005, Revised 2023)	Water scarcity Pollution Deforestation Soil erosion Climate change	The overall policy goal is sustainable management and utilisation of water resources to provide water of acceptable quality and of sufficient quantities, and ensure availability of efficient and effective water and sanitation services that satisfy the basic requirements of every Malawian. The policy aims at ensuring water of acceptable quality for all needs in Malawi and achieving sustainable provision of community-owned and managed water supplies and sanitation services that are equitably accessible to and used by individuals and entrepreneurs in rural communities for socioeconomic development at affordable costs, amongst other things. It promotes watershed management, pollution control, and climate resilience strategies. It emphasises Integrated Water Resources Management (IWRM).
Fisheries and Aquaculture Policy (2016)	Overfishing Aquatic biodiversity loss	The policy emphasises sustainable environmental management by advocating for practices that ensure the sustainable use of fish resources and the protection of aquatic ecosystems. It calls for the establishment of a regulatory framework to enforce conservation measures, the implementation of ecosystem-based management approaches, and the necessity of environmental impact assessments for new projects. Additionally, the policy recognises the impacts of climate change on fisheries, encourages community involvement in conservation efforts, and stresses the importance of educating stakeholders about sustainable practices. These are aimed at balancing resource utilisation with environmental protection to enhance food security and livelihoods. The policy encourages sustainable fishing practices and promotes aquaculture development.
Irrigation Act (2001)	Degradation of wetlands Degradation of water resources Degradation of river buffer zones Siltation Conflicts in water use Pollution and contamination	The Act provides for the sustainable development and management of irrigation, protection of the environment from irrigation related degradation. It calls for the establishment of the National Irrigation Board, the Irrigation Fund, and other matters related to irrigation development in Malawi. It also mandates farmers to maintain irrigation canals, drains, and other associated infrastructure in their holdings and prohibits people from engaging in practices which are destructive or potentially destructive to the catchment area of a river that provides water for irrigation. Furthermore, it prohibits livestock grazing and setting or causing to set fire on irrigation schemes or farms. Although the Act is silent on the maintenance of buffer zones along riverbanks, it prohibits any actions that are destructive to the catchment.

Policy	Environmental Issue Addressed	Rationale and Key Features
Irrigation Policy (2024)	Climate change Water scarcity Food security	The policy's priority areas are land and sustainable irrigation management. It encourages catchment management practices for the benefit of irrigating and non-irrigating communities. It promotes sustainable irrigation management and catchment management practice.
National Sanitation Policy (2006)	Waste disposal Pollution Environmental degradation	The policy focuses on transforming the hygiene and sanitation situation in Malawi. It aims to provide guidelines and an action plan to achieve universal access to improved sanitation. The policy also focuses on ensuring that safe hygienic behaviour becomes the norm and that recycling of solid and liquid waste is widely practised. The goal is to improve the lives of all people in Malawi through healthier living conditions, a better environment, and sustainable wealth creation, encapsulated in the phrase <i>"Umoyo Wabwino!"</i> which translates to "A better life!".
Disaster Risk Management Trust Fund (2023)	Environmental hazards Risks and disasters	Provides funding for disaster risk reduction and climate resilience.

### 9.4.3 Overview of air and climate policies

Air-based policies in Malawi are essential for addressing environmental issues related to air pollution, radiation, and sustainable energy management. The policies are aimed at mitigating the adverse impacts of pollutants on

public health and ecosystems while promoting sustainable development. They establish institutional framework, such as the Atomic Energy Regulatory Authority and the Malawi Energy Regulatory Authority, to oversee compliance with safety and environmental standards. Table 9.6 provides an overview of air based policies in Malawi.

**Table 9.6:** Overview of air-based policy, legal, and institutional frameworks in Malawi

Policy	Environmental Issue Addressed	Rationale and Key Features
Atomic Energy Act (2011)	Ionising radiation risks Air pollution	The Act primarily focuses on the regulation of nuclear energy and radiation safety. It also addresses environmental protection indirectly by ensuring the safe management of radiation sources and radioactive waste. It establishes the Atomic Energy Regulatory Authority to monitor and mitigate radiation exposure.
The Atomic Energy Regulations (2021)	Ionising radiation risks Air pollution	The regulations aim to ensure the safe use of nuclear energy and radiation sources. These regulations are based on international safety standards, such as the International Basic Safety Standards for Radiation Protection and Safety of Radiation sources and are enforced by the Atomic Energy Regulatory Authority. The regulations cover all activities involving radiation sources, including production, possession, use, import, export, transportation, transfer, handling, and disposal. They guide licensing requirements and enforcement mechanisms to ensure compliance with safety standards, indirectly supporting environmental protection by ensuring safe management of radioactive waste and compliance with international standards. While specific air quality regulations fall under broader environmental legislation, the safe management of radiation sources under these regulations contributes to overall environmental safety.

Policy	Environmental Issue Addressed	Rationale and Key Features
National Energy Policy (2018)	Air pollution Energy efficiency	The goal of the policy is to increase access to affordable, reliable, sustainable, efficient, and modern energy for every person in the country. Malawi currently relies on hydro-powered electricity which relies on water. The policy priority area is biomass used for purposes other than electricity generation. The government of Malawi recognised that biomass remains an important source of energy for the foreseeable future. To this end, the policy promotes sustainable production and efficient use of biomass. It also promotes renewable energy and seeks to reduce reliance on biomass for energy production.
Atomic Energy Regulatory Authority Strategic Plan (2021–2030)	Radiation safety Sustainable cities	The plan aligns radiation monitoring with Malawi Vision 2063 and SDGs 11 and 17.
National Livestock Development Policy (2021-2026)	Greenhouse gas emissions Pollution Deforestation Land degradation	The policy aims to improve the contribution of the livestock sector to Malawi's economy while ensuring environmental sustainability as well as aligning livestock development strategies with national and international frameworks for environmental conservation, food security, climate change and methane gas emissions.
Meteorological Policy (2019)	Timely seasonal forecasts Timely and accurate weather information for planning	The policy aims to support government efforts in achieving the Sustainable Development Goals, particularly Goal 2 to achieve zero hunger which involves promoting sustainable agricultural practices. It also supports Goal 13 on enhancing climate actions through provision of continued systematic weather and climate observations, data analyses, and weather and climate forecasts that are the basis for up-to-date climate information for the development of climate change adaptation and mitigation strategies as part of the countries obligations under United Nations Framework Convention on Climate Change. The policy seeks to achieve effective and efficient generation, dissemination, and utilisation of reliable, responsive, high quality, up-to-date and timely meteorological services, and to enhance community resilience to weather and climate shocks.
National Industrial Policy (2016)	Environmental degradation Resource exploitation Pollution	The policy directs how Malawi can develop its productive economy and industrialise. The policy goal is to increase the proportion of manufacturing in GDP through structural transformation of the Malawian economy. The aim is to address the environmental and social sustainability concerns of industrialisation.
Renewable Energy Strategy (2017-2030)	Deforestation	The strategy prioritises expanding access to sustainable energy sources while reducing reliance on traditional biomass. It focuses on key objectives such as increasing electricity access, advancing bioenergy sustainability, and improving energy infrastructure. Additionally, it seeks to deliver Malawi's renewable energy ambitions, as highlighted in the National Energy Policy, by setting an actionable agenda that promotes renewables and strengthens the sector's regulatory, fiscal, and legal frameworks.

Policy	Environmental Issue Addressed	Rationale and Key Features
National Framework for Water and Climate Services (2024-2029)	Environmental degradation Sustainable urbanisation Biodiversity loss Desertification	The policy framework aims to improve the country's resilience to climate-related risks and the country's ability to adapt to climate variability and climate change. It aligns with national policies like Malawi Agenda 2063 and integrates disaster risk reduction with climate change adaptation and mitigation strategies. The framework promotes collaboration among government agencies, research institutions, NGOs, private sector partners, and local communities to address challenges such as floods, droughts, and severe winds.

#### 9.4.4 Overview of biodiversity policies

Malawi has established a comprehensive framework for environmental protection and sustainable development focusing on biodiversity. There are multiple environmental policies and strategies, either in

implementation or under review, aimed at addressing key issues such as biodiversity loss, deforestation, water scarcity, pollution, invasive species, and the impacts of climate change. Table 9.7 provides an overview of Malawi's policy landscape related to biodiversity protection and management

**Table 9.7:** Overview of biodiversity policy, legal, and institutional frameworks in Malawi

Policy	Environmental Issue Addressed	Rationale and Key Features emphasised
National Water policy (2005)	Water scarcity Water quality Watershed management Climate change Wetlands degradation Extraction of water resources Invasive species	The policy covers ecosystem health, water quality monitoring, Integrated Water Resources Management, conservation of wetlands, community participation, climate resilience strategies, protection of ecosystems, and education and awareness.
National Agriculture Policy (2025)	Land degradation Deforestation Habitat loss Water resource pollution Climate change Loss of agricultural biodiversity	The policy deals with agroecological practices, conservation of indigenous varieties, Integrated Water Resources Management, community participation in resource management, research and innovation.
Agricultural Land Resources and Management Policy (2025)	Agricultural and farming practices Loss of biodiversity due to agricultural expansion	The policy promotes sustainable agricultural practices and encourages integrated land use planning. It provides strategies for water resource management, habitat protection and restoration, research and education, community involvement, and stakeholder engagement.
Fisheries and Aquaculture Policy (2016)	Sustainable fisheries practices Habitat degradation Invasive species	The policy advocates for practices that ensure the sustainable management and use of fish resources and the protection of aquatic ecosystems.

Policy	Environmental Issue Addressed	Rationale and Key Features emphasised
National Biodiversity Strategy and Action Plan II (2015)	Habitat loss and degradation Conservation Biodiversity loss Climate change	The plan provides Malawi's strategies and action plans for the management of biodiversity.
National Seed Policy (2018)	Biological contamination Loss of biodiversity Agro-ecosystems services	Recognising agriculture's vital role in the nation, the policy aims to modernise the seed sector by addressing gaps in the previous 1993 policy and incorporating modern developments. It regulates seed quality, information systems, production standards, biotechnology, marketing, and education. Furthermore, it details implementation arrangements and a monitoring and evaluation plan to ensure the policy's objectives of enhanced agricultural productivity and food security are met through a well-regulated and efficient seed industry.
National Energy Policy (2018)	Deforestation Sustainable use of natural resources	The policy prioritises area sustainable use of biomass for purposes other than electricity generation.
National Forest Landscape Restoration strategy (2018-2030)	Depletion of water resources Land degradation	The strategy outlines restoration opportunities and priority interventions enabled by new agricultural technologies, community forests and woodlots, forest management, soil and water conservation, as well as river- and stream-bank restoration.
Chambo Restoration Strategy (2005)	Overfishing Habitat destruction	It is focused on the conservation and restoration of the Chambo fish species ( <i>Oreochromis lidole</i> ), which is culturally and economically important in Malawi, particularly in Lake Malawi. The plan addresses environmental issues related to the broader ecosystem in which the Chambo resides.  It promotes sustainable fishing practices such as gear restrictions, closed seasons, and catch monitoring alongside habitat protection through the designation of breeding sanctuaries and riparian buffer zones and encourages community led governance.
National E-waste Management Policy (2024)	Ecosystem degradation Soil and water contamination Pollution	This policy provides a unified framework for sustainable and standardised electronic waste management in Malawi. It offers guidance for addressing challenges related to electrical and electronic equipment waste, aiming to minimise its impact on human health and the environment, in alignment with national priorities and international commitments such as the SDGs.
National Aquaculture Strategic Plan (2021–2031)	Pollution Resource exploitation Invasive species Ecosystem degradation	The plan emphasises the promotion of climate-resilient and environmentally sustainable aquaculture practices to ensure long-term productivity and ecological balance. Recognising the impact of environmental degradation and climate change on natural fish stocks and farming conditions, the strategy integrates environmental sustainability as one of its core themes. It supports the adoption of eco-friendly technologies, responsible water use, and sustainable waste management, aligning with both national environmental policies and international frameworks like the SDGs and African Union Agenda 2063, to protect ecosystems while enhancing fish production.

### 9.4.5 Indigenous and Local Knowledge (ILK) integration into national policy

There is growing recognition of the cultural heritage and traditional knowledge of Indigenous Peoples and Local Communities, and their significant contributions

to environmental conservation efforts and climate change responses at both national and global levels. Table 9.8 provides an overview of critical gaps and provides actionable recommendations for strengthening national policy.

**Table 9.8:** Indigenous and Local Knowledge (ILK) integration into national policy and legal frameworks

Category	Policy/ Legal Framework	ILK Integration	Gaps Identified	Recommendations
Overarching policies	Constitution (1994)	Limited	There is no explicit reference to ILK rights or recognition.	Include ILK rights under environmental protection and community participation clauses.
	Malawi Vision (2063)	Limited	There is no clear reference to ILK rights or recognition.	Include ILK rights under environmental protection and community participation as part of the Human Rights Based Approach.
	Environmental Management Act (2017)	Moderate	It has general references to community participation and is not ILK-specific.	The Act should add ILK safeguards and procedures in Environmental Impact Assessments (EIA).
	National Resilience Strategy (2018-2030)	There are some ILK applications	It mainly focuses on livelihoods; it is weak on ILK systems.	Link ILK to ecosystem-based adaptation strategies.
	National Climate Change Management Policy (2016)	Emerging	Some sections mention vulnerable groups and not ILK.	Promote climate resilience strategies derived from ILK.
	Decentralization Policy (2024)	Moderate	There are no clear ILK advisory structures.	Need to formalise representation of ILK in advisory structures such as district environmental subcommittees.
	Urban Policy (2019)	Minimal	It overlooks the role of ILK in urban green spaces and food systems.	Integrate ILK in urban planning, waste management, and community gardens.
	National Adaptation Plan and Nationally Determined Contributions (2021)	Mentions emerging ILK issues	Weak follow-through in implementation.	Institutionalise ILK in climate adaptation, planning, and budgeting.

Category	Policy/ Legal Framework	ILK Integration	Gaps Identified	Recommendations
Land policies	Forest Act Amendment (2020) and National Forest Policy (2006)	They are both strong in participatory approaches	ILK is not clearly defined, recognised, or protected.	Need to embed ILK in forest co-management models.
	Greenbelt Initiative	Very limited	ILK is not formally recognised in policy or strategy.	Embed ILK into the planning, implementation, and monitoring of irrigation and land-use projects.
	Customary Land Act (2016)	Implicitly embeds ILK principles and recognises customary authority, community participation, and traditional land-use practices.	ILK is not clearly defined, recognised, or protected.	Define ILK and its role in land governance. Consider ILK in land allocation, environmental assessments and land-use planning.
	National Fertiliser Policy (2021)	Limited	It focuses on chemical fertilisers with no reference to traditional soil management practices.	Support ILK in composting, organic fertilisation, and soil fertility management.
	Land Act (2016) and National Land Policy	Limited	They both focus on land tenure and overlook traditional land use and ownership.	Need to recognise ILK in customary land governance and conflict resolution.
	Mines and Minerals Policy (2013)	Very limited	No ILK inclusion or cultural site protection.	Protect sacred sites and traditional ecological zones when licensing mining activities.
	Agriculture Land Resources Management Policy (2024)	Moderate	Focuses on conservation agriculture, missing cultural land-use knowledge.	Incorporate ILK into sustainable land use and agrobiodiversity planning.

Category	Policy/ Legal Framework	ILK Integration	Gaps Identified	Recommendations
Water policies	Water Resources Act (2013) and National Water Resources Policy (2005, Revised 2023)	Moderate	They both lack community co-management mechanisms informed by ILK.	Include traditional water knowledge in catchment and wetland management plans.
	Fisheries and Aquaculture Policy (2016)	Moderate	Limited to co-management models.	Integrate ILK into seasonal fishing bans and spawning practices.
	Irrigation Act (2001) and National Irrigation Policy (2024)	Very limited	There is the technical focus which ignores traditional irrigation knowledge.	Promote ILK traditional water harvesting techniques.
	Disaster Risk Management Act (2023)/ policy (2015)	Limited	ILK on early warning signs is not integrated.	Develop ILK-driven community disaster preparedness strategies.
	National Sanitation Policy (2006)	Very limited	Ignores traditional sanitation practices and beliefs.	Promote ILK in culturally appropriate hygiene education and practices.
Air policies	National Energy Policy (2018)	Minimal	It overlooks bioenergy knowledge systems.	Incorporate ILK in biomass and charcoal alternatives search.
	Atomic Energy Act (2011)	Very limited	Focuses on radiation protection, nuclear safety, and regulatory control and does not reference ILK.	Need to have ILK-informed environmental assessments, and culturally grounded risk communication in all radiation-related activities.
	Renewable Energy	Very limited	It ignores traditional energy sources and community innovations.	Leverage ILK in biomass, solar, and cooking technologies adoption.
	National Framework for Water and Climate Services	Limited	Focuses on technical data and community resilience practices.	Embed ILK in climate forecasting, flood management, and water governance.
	Transport Policy (2015)	Minimal	It focuses on technical infrastructure and lacks ILK consideration.	Consider ILK in rural access planning and transport impacts on sacred sites.

Category	Policy/ Legal Framework	ILK Integration	Gaps Identified	Recommendations
Biodiversity policies	National Charcoal Strategy	Limited	Focuses on regulation, and not on traditional fuel-saving methods.	Promote ILK in energy-saving cooking practices.
	National Biodiversity Strategy and Action Plan (NBSAP II) (2015)	Strong	It lacks operationalisation of ILK mainstreaming.	Ensure the revised NBSAP has ILK reflected in biodiversity indicators and monitoring tools.
	Wildlife Policy	Moderate	It recognises communities but not their knowledge systems.	Strengthen community-based conservation with ILK documentation tools.
	National Forest Landscape and Restoration Strategy (2018-2030)	Moderate	Implementation does not reflect ILK contributions.	Use ILK in species reintroduction and soil conservation.
	National Seed Policy (2018)	Very limited	It emphasizes certified seed, marginalising traditional seed systems.	Need to recognise and protect traditional seed varieties and farmer knowledge.



Stream bank farming is prohibited, but the practice is common along water bodies in Malawi. Photo: Glory Muva

## 9.5 Institutional frameworks

To ensure policy implementation, inter-ministerial and inter-agency collaboration, and service delivery at both national and local levels in the environmental sector, the Government

of Malawi set up ministries, departments, agencies, district offices, as well as community structures. Table 9.9 illustrates the structural arrangement and coordination among key ministries, departments, and agencies.

**Table 9.9:** Institutional frameworks

Office of the president and cabinet	National		District	Communities
	Ministries	Departments/Agencies		
Office of the president and cabinet	Presidential Delivery Unit	<ul style="list-style-type: none"> <li>National Planning Commission</li> </ul>	<ul style="list-style-type: none"> <li>District Commissioner</li> <li>Directorate of Planning and Development</li> <li>Directorate of Public Works</li> </ul>	<ul style="list-style-type: none"> <li>Local Development Committees</li> </ul>
		<ul style="list-style-type: none"> <li>Department of Disaster Management Affairs</li> </ul>	<ul style="list-style-type: none"> <li>District Disaster Risk Management Office</li> </ul>	<ul style="list-style-type: none"> <li>Area/Village Disaster Risk Management</li> </ul>
	Ministry responsible for Environment	<ul style="list-style-type: none"> <li>Environmental Affairs Department</li> <li>Malawi Environmental Protection Authority (MEPA)</li> <li>Department of Climate Change and Meteorological Services</li> <li>Department of Forestry</li> <li>Department of National Parks and Wildlife</li> <li>Fisheries Research Institute of Malawi</li> <li>Malawi College of Fisheries</li> <li>Forest Research Institute of Malawi</li> <li>National Council on the Environment</li> <li>National Herbarium and Botanic Gardens of Malawi</li> <li>National Plant Genetic Resource Centre</li> <li>Museums of Malawi</li> </ul>	<ul style="list-style-type: none"> <li>District Environment Office</li> <li>District Forestry Office</li> <li>District Fisheries Office</li> </ul>	<ul style="list-style-type: none"> <li>Natural Resources Management Committees</li> <li>Beach Village Committees</li> </ul>
Ministry responsible for Local Government	<ul style="list-style-type: none"> <li>Department of Local Government Service</li> <li>Directorate of Chiefs Administration</li> <li>Directorate of Rural Development</li> </ul>	<ul style="list-style-type: none"> <li>District Councils</li> <li>District Development</li> <li>City Councils Committees</li> </ul>	<ul style="list-style-type: none"> <li>Village Development Committee</li> <li>Area Development Committee</li> <li>Local Leaders</li> </ul>	

Office of the president and cabinet	Ministry responsible for Finance and Economic Affairs	<ul style="list-style-type: none"> <li>• Department of Debt and Aid</li> <li>• Department of Treasury</li> </ul>	<ul style="list-style-type: none"> <li>• Local Government Finance Committee</li> <li>• District Commissioner</li> <li>• Directorate of Planning and Development</li> </ul>	
	Ministry responsible for Lands	<ul style="list-style-type: none"> <li>• Department of Lands</li> <li>• Regional Lands Office</li> </ul>	<ul style="list-style-type: none"> <li>• District Lands Office</li> </ul>	<ul style="list-style-type: none"> <li>• Land Management Committees</li> </ul>
<b>National</b>			<b>District</b>	<b>Communities</b>
	<b>Ministries</b>	<b>Departments/Agencies</b>		
	Ministry responsible for Foreign Affairs	<ul style="list-style-type: none"> <li>• Protocol Directorate (Division of Government Protocol)</li> </ul>		
	Ministry responsible for Energy	<ul style="list-style-type: none"> <li>• Atomic Energy Regulatory Authorities</li> <li>• Malawi Energy Regulatory Authority</li> <li>• Electricity Generation Company</li> <li>• Electricity Supply Corporation of Malawi</li> </ul>	<ul style="list-style-type: none"> <li>• District Energy Office</li> </ul>	
	Ministry responsible for Water and Sanitation	<ul style="list-style-type: none"> <li>• Department of Water Resources</li> <li>• National Water Resources Authority</li> <li>• Department of Sanitation and Hygiene</li> <li>• Department of Policy and Planning</li> </ul>	<ul style="list-style-type: none"> <li>• District Water Office</li> <li>• Water Resources Office</li> <li>• Water Boards</li> </ul>	<ul style="list-style-type: none"> <li>• Catchment Management Committees</li> <li>• Water Resources Management Committees</li> <li>• Water Users Associations</li> </ul>
	Ministry responsible for Agriculture	<ul style="list-style-type: none"> <li>• Department of Agriculture Extension Services</li> <li>• Department of Animal Health and Livestock Development</li> <li>• Department of Agricultural Planning Services</li> <li>• Department of Land Resources</li> <li>• Department of Agriculture Research Services</li> <li>• Department of Crop Development</li> <li>• Greenbelt Authority</li> <li>• Agriculture Research and Extension Trust</li> <li>• Department of Irrigation</li> </ul>	<ul style="list-style-type: none"> <li>• District Agriculture Development Office</li> <li>• District Agriculture Extension Office</li> <li>• District Crops Office</li> <li>• District Irrigation Office</li> <li>• District Land Resources Office</li> </ul>	<ul style="list-style-type: none"> <li>• Agriculture Development Area Office</li> <li>• Lead Farmers</li> <li>• Agriculture Cooperatives</li> </ul>

	Ministry responsible for Gender, Community Development and Social Welfare	<ul style="list-style-type: none"> <li>• Department of Gender Affairs</li> <li>• Department of Community Development Services</li> </ul>	<ul style="list-style-type: none"> <li>• District Gender Office</li> <li>• District Social Welfare Office</li> <li>• District Community Development Office</li> </ul>	<ul style="list-style-type: none"> <li>• Community Development Officers</li> </ul>
	Ministry responsible for Trade and Industry	<ul style="list-style-type: none"> <li>• Department of Trade</li> </ul>	<ul style="list-style-type: none"> <li>• District Commissioner</li> <li>• Directorate of Planning and Development</li> </ul>	<ul style="list-style-type: none"> <li>• Local cooperatives</li> </ul>
<b>National</b>			<b>District</b>	<b>Communities</b>
	<b>Ministries</b>	<b>Departments/Agencies</b>		
	Ministry responsible for Education	<ul style="list-style-type: none"> <li>• National Council for Science &amp; Technology</li> <li>• Division Offices</li> <li>• Malawi Institute of Education</li> <li>• University of Malawi</li> <li>• Mzuzu University</li> <li>• Lilongwe University of Agriculture and Natural Resources</li> <li>• Malawi College of Forestry and Wildlife.</li> <li>• Malawi University of Science and Technology</li> </ul>	<ul style="list-style-type: none"> <li>• District Education Offices</li> </ul>	
Parliament of Malawi	Parliamentary Committee on Natural Resources and Climate Change  Parliamentary Conservation Caucus	<ul style="list-style-type: none"> <li>• Department of Local Government Service</li> <li>• Directorate of Chiefs Administration</li> <li>• Directorate of Rural Development</li> </ul>	<ul style="list-style-type: none"> <li>• District Councils</li> <li>• District Development Committees</li> </ul>	<ul style="list-style-type: none"> <li>• Village Development Committee</li> <li>• Area Development Committee</li> <li>• Local Leaders</li> </ul>
Judiciary	Ministry responsible for Agriculture	Directorate of Public Prosecutions High Court and Supreme Courts	Magistrate Courts Police	Local courts

## 9.6 Effectiveness of current policies

### 9.6.1 Policy complementarity and conflicts

Malawi's environmental management and development policies demonstrate both complementarities and conflicts across sectors, although all emphasise the promotion of sustainable development. While some policies effectively align with national goals, others face challenges due to enforcement gaps and conflicting priorities.

#### 9.6.1.1 Policy complementarity and synergies

- **Land Policy:** The 2002 National Land Policy laid the groundwork for addressing land management issues. However, post-2010 updates have been limited, failing to fully address the needs of a growing population. The 2016 updates, through the Land Act and Customary Land Act, strengthened land administration and formalisation, promoting security of land tenure.

- **Forestry Policy:** The National Forest Policy (2016) adopts a holistic approach to sustainable forest management, addressing critical issues such as climate change, food security, biodiversity, Payments for Ecosystem Services, and Clean Development Mechanisms (CDM), while aligning with other national policies. It integrates with Malawi's medium-term development strategy through emphasising sustainable forest resource management. Policies that are complementary to the Forestry Policies include the National Environmental Policy (2004), which coordinates natural resource management; the National Land Policy (2002), promoting equitable access and sustainable land use; the National Decentralisation Policy (2024), devolving forestry management to local governments; the Land Resources Management Policy (2000), advocating tree planting and conservation; National Energy Policy (2018), promoting alternative energy sources to reduce biomass dependency; and the National Population Policy (2013), which addresses population growth's role in deforestation. The strategies that directly support the Forestry Policy like the National Forest Landscape strategy (2018-2030) align with global restoration commitments such as the Bonn Challenge that seeks to restore 4.5 million hectares of land by 2030 while promoting community participation and sustainable resource use.
- **Agriculture and Forestry Policies (2016):** Agroforestry practices promoted by both policies align with environmental conservation and food security objectives, offering a dual benefit of soil conservation and increased agricultural yields. Agroforestry is scientifically proven to improve soil fertility. Promising results have emerged where maize yields increased by up to 280 per cent under the canopy of *Faidherbia* trees compared with the zones outside (World State of Lands and Water Report 2021).

#### 9.6.1.2 Conflicts

- **Mining vs forestry:** Mining operations often conflict with forestry conservation efforts. For example, hotspots such as Kayelekera have experienced significant deforestation due to unregulated mining activities. Additionally, the Mines and Minerals Act often overrides forestry regulations, exacerbating deforestation in areas like Kasungu and Mzimba.
- **Water vs agricultural policies:** These policies aim to enhance food production. The agricultural and irrigation policies, which promote irrigation activities, often target areas that are close to water sources, including wetlands and along riverbanks. Such practices contradict the Water Resources Act provision of a 30-meter buffer zone from a water source such as a river.

- **Public construction vs environmental standards:** Compliance with environmental safeguards in construction projects remains inadequate. Large-scale infrastructure developments often sideline Environmental Impact Assessments, contributing to land degradation and biodiversity loss.

## 9.7 Institutional effectiveness

Malawi's institutions tasked with environmental management and natural resource conservation face significant challenges in achieving their mandates. While there have been notable successes, systemic gaps in funding, human resources, and coordination hinder comprehensive and sustainable outcomes.

### 9.7.1 Institutional capacity and coordination

Key institutions such as the Ministry of Lands, Forestry Department, and Environmental Affairs Department play critical roles in policy implementation and resource management. However, these institutions face significant challenges:

- **Capacity gaps:** Staffing levels in many districts are often below the required capacity, leaving institutions unable to adequately implement and monitor programmes. Staff shortages also significantly hinder the implementation and monitoring of environmental policies, particularly in rural and underserved districts.
- **Coordination issues:** Overlaps and weak inter-ministerial coordination among departments, such as Agriculture, Forestry, and Environmental Affairs, have slowed down the implementation of cross-cutting policies, such as agroforestry and integrated land-use planning. The lack of harmonised efforts among key ministries and departments, coupled with overlapping mandates, has undermined the integrated approach needed for addressing complex environmental challenges.
- **Limited funding:** Forestry and environmental conservation receive less than 0.1 per cent of GDP annually, leaving critical programmes underfunded and reliant on donor contributions.
- **Regulatory weaknesses:** Insufficient enforcement of existing regulations, such as those preventing illegal logging, continues to undermine reforestation and conservation efforts.

## 9.8 Co-benefits and competitiveness

Malawi's environmental and sectoral policies are designed to foster sustainable practices, which not only protect natural resources but also generate multiple co-benefits that enhance the country's competitiveness. These policies span various sectors including land, agriculture,

food security, mining, and forestry, with each contributing to environmental health and economic growth.

### 9.8.1 Agroforestry and sustainable agriculture: enhancing soil health and productivity

Agroforestry, which falls under both the Agriculture and Forestry Policies, has created significant co-benefits for Malawi. By promoting the incorporation of trees into agricultural systems, agroforestry improves soil fertility, enhances water retention, and supports biodiversity, while simultaneously increasing agricultural productivity. These practices help farmers increase yields and reduce soil erosion, directly benefiting local communities. In addition, agroforestry systems sequester carbon, playing an important role in climate change mitigation.

Policies that support sustainable agriculture also align with food security goals, ensuring stable food production while reducing reliance on harmful agricultural practices. This integration strengthens the resilience of food systems and boosts national competitiveness by ensuring sustainable agricultural practices that meet both local and global demands.

### 9.8.2 Land policy: promoting tenure security and supporting economic growth

The National Land Policy (2016), alongside laws such as the Land Act (2016) and Customary Land Act (2016), has contributed significantly to land tenure security. While the policy has helped to formalise land rights for many, it has also facilitated investment in agriculture and infrastructure, enhancing the overall competitiveness of the rural economy. However, marginalised groups, particularly women and youth, still face challenges in accessing land, which limits the full economic potential of these policies.

Improved land tenure systems support sustainable agricultural practices, encourage private sector investment, and provide greater access to credit, fostering both agricultural and economic growth. By ensuring land security, these policies empower individuals and communities to sustainably manage their land resources, thus contributing to broader socio-economic development.

### 9.8.3 Sustainable mining and environmental protection: boosting exports and climate resilience

The mining sector, governed by the Mines and Minerals Act (2019) and the Mining (Environmental Protection) Regulations (2017), has the potential to contribute significantly to Malawi's economic competitiveness. Policies promoting sustainable mining practices have enhanced environmental protection, with regulations requiring companies to manage their environmental impact through land reclamation and waste management. This results in good water resources management through reduced pollution.

Mining policies also provide an avenue for generating revenue from natural resources, with the potential for reinvesting in communities. For example, sustainable practices in mining not only preserve the environment but can also lead to the creation of jobs, infrastructure development, and increased revenue from the export of responsibly mined resources. Despite challenges, such as illegal mining and inadequate enforcement, policies that align environmental protection with economic goals continue to improve Malawi's competitiveness in the global mining market.

### 9.8.4 Food security policies: integrating climate resilience and community empowerment

The Food Security Policy (2006), along with its supporting legislation, emphasises sustainable food production systems that increase resilience to climate change. This policy promotes integrated farming practices, such as crop rotation and water-efficient technologies that help communities adapt to changing climate conditions while maintaining food security. By increasing agricultural productivity and fostering resilience, Malawi enhances its competitiveness in food exports and strengthens food systems across the country.

Community-based initiatives have proven effective in enhancing food security, particularly for vulnerable groups. Empowering local communities to participate in sustainable food production not only improves food access but also supports the broader goal of reducing poverty and malnutrition.

### 9.8.5 Forestry policies: conserving biodiversity and supporting sustainable timber exports

Under the National Forestry Policy (2016) and the Forestry Act (2017), sustainable forest management practices have provided crucial co-benefits such as biodiversity conservation, carbon sequestration and improved soil health. These practices not only safeguard Malawi's forest resources but also provide a steady supply of sustainably sourced timber for export.

## 9.9 Overbearing policies

Overbearing policies, particularly in the mining sector, have undermined land and biodiversity conservation and environmental sustainability efforts in Malawi. These policies often prioritise economic growth from resource extraction over environmental protection, leading to unintended consequences for forest and water ecosystems, land-use management, and biodiversity. In Nkhotakota Game Reserve and Dzalanyama Forest Reserve, mining operations have encroached into protected lands, directly threatening biodiversity and the integrity of forest ecosystems. These conflicts between mining and land conservation highlight the inherent tension between resource extraction and environmental protection, with mining policies often overriding

regulations aimed at preserving land, forests, and biodiversity for future generations.

The National Water Policy has improved access to water, particularly through projects like borehole rehabilitation and piped water systems. However, rural areas remain underserved due to infrastructure and resource constraints. Integrated Water Resources Management (IWRM) has fostered collaboration across sectors, yet conflicts between agricultural practices and water conservation persist. For example, disregard for mandated buffer zones along rivers exacerbates water body pollution and catchment degradation.

## 9.10 Enabling and constraining factors

Land-based policies in Malawi, such as those relating to forestry, agriculture, mining, land management, and food security, face a complex interplay of enabling and constraining factors. While some key factors support the successful implementation of these policies, significant challenges continue to undermine their effectiveness.

### 9.10.1 Enabling factors

- Strong political support for policies, such as the National Forestry Policy and the National Land Policy, has been an enabler for addressing environmental issues. Politicians, especially at the local level, have recognised the importance of sustainable land management and forest conservation in the face of climate change and biodiversity loss. This support has driven policy reforms and encouraged the involvement of both national and local stakeholders in policy implementation, particularly in the forestry and land sectors.
- Increased community engagement has significantly contributed to the success of community-based natural resource management initiatives. Programmes focusing on agroforestry, land tenure rights, and sustainable agriculture have successfully raised awareness and mobilised local populations to actively participate in policy implementation. This grassroots involvement is crucial for the sustainability of policies, particularly those aimed at forest conservation and soil fertility enhancement.

### 9.10.2 Constraining factors

- Persistent funding gaps remain a significant constraint to the effective implementation of policies.
- Weak enforcement of policies, especially in sectors such as mining and forestry, undermines their effectiveness. For example, despite the provisions in the Mines and Minerals Act (2019), mining activities continue to encroach into protected forest areas, such as Viphya Plantation and Dzalanyama Forest Reserve, due to poor enforcement of environmental safeguards

(Kachaje *et al.* 2018; Phiri *et al.* 2019; UNEP 2016; Chidumayo and Gumbo 2013). Similarly, deforestation persists in mining hotspots like Kayelekera, where mining regulations often conflict with forestry management efforts (Phiri *et al.* 2019; Mwanza 2014). The lack of robust enforcement mechanisms makes it difficult to ensure compliance with land-use and environmental regulations.

- Shifting political priorities lead to policy inconsistencies and disruption in the continuity of environmental programme. For example, lack of a consistent policy framework for urbanisation continues to undermine progress in areas such as land tenure and sustainable urban development.
- Many institutions responsible for implementing environmental policies, such as the Forestry Department, Ministry of Lands, and Environmental Affairs Department, face capacity gaps especially at local levels. The lack of human and technical resources hampers the successful implementation of policies aimed at sustainable land management, food security, and mining regulation.
- Despite the National Land Policy (2016), land tenure insecurity remains a significant barrier to effective land use and management. The policy has made strides in improving land tenure security for some, but marginalised groups, such as women and youth, continue to face challenges in securing land rights.
- Weak coordination between ministries, such as those responsible for land, agriculture, and mining, hinders the implementation of integrated approaches to environmental policies. Overlaps between sectors and unclear roles often lead to policy conflicts and regulatory inefficiencies. For instance, the Forestry Policy and Mines and Minerals Act (2019) sometimes have competing objectives, with the mining sector often taking precedence over forestry conservation efforts, particularly in areas with rich mineral resources.

## 9.11 Conclusion

Malawi has developed several policies to guide sustainable environmental management and natural resource governance. These policies reflect the country's alignment with global, regional, and national commitments, particularly Malawi Agenda 2063 and the Sustainable Development Goals (SDGs). The policies address critical domains such as land, water, air, and biodiversity. The domestication of international agreements, the creation of sectoral policies, and the establishment of specialised authorities all demonstrate progress made and a growing commitment to sustainability, resilience, and inclusive development. However, the effectiveness of these frameworks has been mixed, especially in the implementation phase. Persistent challenges such as

weak enforcement mechanisms, inadequate financing, limited technical capacity particularly at subnational levels, and fragmented institutional coordination continue to hinder progress. Limited mainstreaming of Indigenous and Local Knowledge in the regulatory framework further constrains efforts to implement locally grounded and culturally appropriate environmental solutions.

The success of environmental governance in Malawi depends on addressing implementation gaps, including strengthening institutional and technical capacity, enhancing cross-sectoral policy coherence, improving data

systems, and ensuring inclusive stakeholder participation. To ensure coherence, responsiveness, and accountability, several critical policies that remain outdated or missing need to be developed, reviewed, or validated. These include the absence of a dedicated National Wetlands Policy and the outdated National Environmental Policy (2004), and National Water Policy (2005). Fragmentation, inconsistencies between policies and legal instruments, weak monitoring and evaluation systems, and limited policy incentives for sustainable practices continue to undermine effective implementation.



Plastic pollution is a growing problem across Malawi and the rest of the world. Photo: MEPA

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Photo: Horst Vogel.

# 10 Scenarios



**Coordinating Lead Authors:** Elias Mwakilama; Maggie Munthali  
**Lead Authors:** Hussen Milanzi; Charles Kapachika  
**Chapter Fellow:** Richard Moyo

## Executive summary

**Additional policies and changes in behaviour and practices are needed in order to reverse trends in environmental degradation and ensure the achievement of goals and targets under the Sustainable Development Goals and Malawi Agenda 2063** (*well established*). Under the Business as Usual scenario, population growth, urban expansion, and sluggish economic development will cause a significantly increased demand for food, energy, and water. Human population density in Malawi, which increased from 157 persons per square kilometre in 2010 to 230 persons per square kilometre in 2024, will remain one of the major drivers of environmental change in the country. The lack of alternative and cheaper fuel sources is a significant environmental pressure, which will result in an insignificant shift in the 96 per cent contribution of biomass to energy for cooking. {10.3}

**Despite having ambitious policies such as Malawi Agenda 2063, the country is not on track to achieve the environmental dimension of the targets and goals for energy, health, food and nutrition, and waste management** (*established but incomplete*). Progress is

too slow to achieve these targets and goals due to lack of political will and institutional support. The Policy First scenario is good on paper but weak in practice without significant institutional reforms. {10.4}

**Pathways for transformative change are possible for a healthy and prosperous population and healthy environment in Malawi, where goals and targets as those under Malawi Agenda 2063 are achievable** (*established but incomplete*). Strong institutions and clear pathways result in a transition towards resource use efficiency and sustainable consumption and production of food, energy, and water, leading to universal access to basic human needs in an environment where the impacts and magnitude of land degradation, climate disasters, air pollution, and water stress are reduced. Measures to strengthen human livelihoods and institutional capacity lead to the creation, preservation, protection, and sustenance of value of the environment, with society advancing towards a future that we want under the Target Seeking scenario. {10.5}



Malawi's population is dominated by young people. Photo: Glory Muva

## 10.0 Introduction

According to Hughes (2019), Malawi is facing challenges of air pollution, biodiversity loss, land degradation, and poor waste management, all of which threaten the long-term health and sustainability of the country's natural resources (Ngwira and Watanabe 2019). These issues pose significant risks to the livelihoods and well-being of people, particularly the most vulnerable communities, which live in degraded and fragile areas. Furthermore, these challenges are exacerbated by factors such as climate change impacts, rapid population growth, unsustainable land use, urbanisation, and deep-rooted poverty.

The aim of this chapter is to provide a comprehensive exploration of the outlook of Malawi's environmental landscape under varying assumptions. It presents an in-depth analysis of key trends, policy options, and strategies expected to address these challenges and shape the country's environmental landscape for the coming decades. Additionally, it outlines the methodologies and approaches used to develop future scenarios. These methods are designed to create plausible and informed projections that will guide decision-makers and policymakers, stakeholders, and researchers to navigate the complexities and uncertainty of Malawi's environmental future.

The current report describes the state of the environment in Malawi based on the three proposed scenarios, namely: Scenario 1: poor governance and slow economic prosperity, herein referred to as Business as Usual Scenario 2: Good policy reforms but dismal development, herein referred to as Policy First 'teeter'; and Scenario 3:

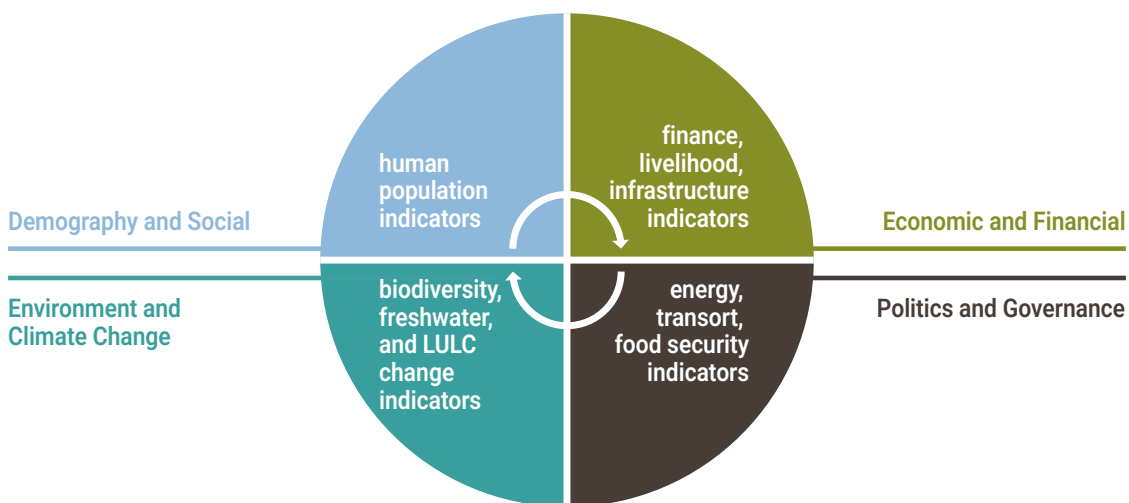
Good governance and sustainable development, here in referred to as Target Seeking.

The chapter adopts a mixed methods approach with narrative-driven storylines (qualitative) and data-driven (GIS, dynamic models) or mathematical modelling (quantitative) to describe current and project comprehensive and plausible future environmental scenarios for Malawi to time ranges of 2050 to 2100. Focus is on how each of the three scenario plays out with the expansion of agricultural land, habitat destruction and zoonosis, inflows, outflows and changes in lake levels, and maximum and minimum temperatures. Impacts on livelihoods under each scenario are also discussed, and so are likely sideswipes through pandemics and disasters.

## 10.1 Drivers of Malawi's future state of the environment

Malawi is facing an environmental cycle of decline and degradation, fuelled by population growth which places huge demands on natural systems where more land is converted to agriculture and more forests are harvested unsustainably for the supply of wood fuel. Climate change also puts greater strain on land and forests due to increased incidents and intensity of natural disasters and extreme weather events. These key drivers are aggravated by other proximate governance drivers such as weak land tenure policies, unsustainable land management practices, chronic shortages of public funding for environmental management, and weak institutions. Figure 10.1 lists four main drivers which shape the future state of Malawi's environment: demography and society, economy and finance, environment and climate change, and politics and governance, along with indicators for each driver.

### Four key drivers used in the Malawi NSEOR Scenarios



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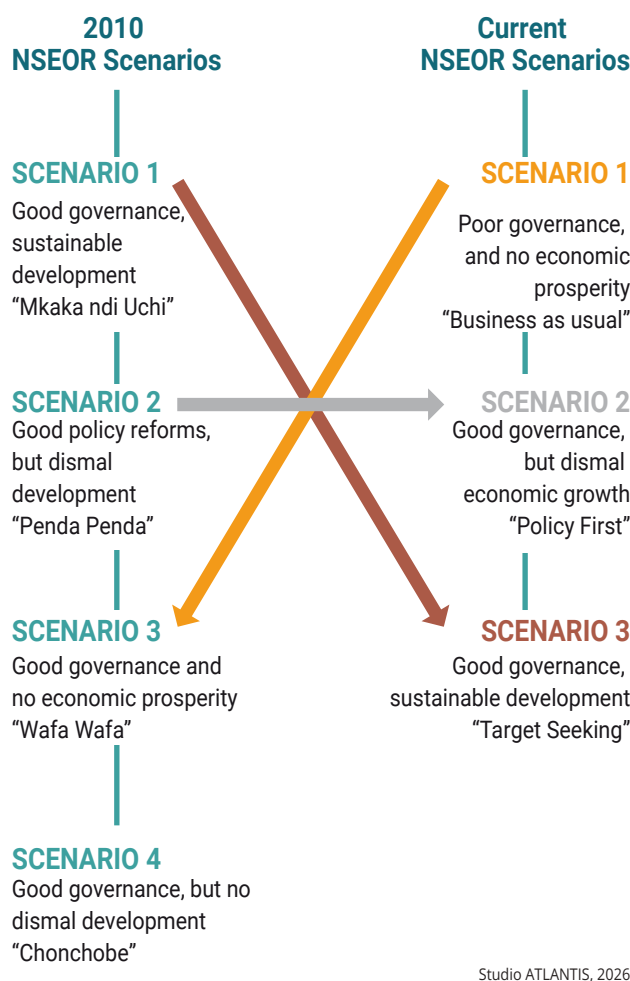
**Figure 10.1:** Four key drivers of Malawi Environmental Scenarios and their Indicators

## 10.2 Characterisation of scenarios

Scenarios are crucial for policymakers to identify the potential impacts of various policy options, explore different alternative future pathways, and guide actions towards environmental sustainability. An adaptive, participatory, and consultative process was deployed to develop the scenarios with chapter authors and experts from government, civil society, and academic institutions. The consultations led to consensus on three scenarios as shown in Figure 10.2. The scenarios were built around those presented in the National State of the Environment and Outlook Report of 2010 (Government of Malawi 2010).

Integrating scenario-building in planning is essential for understanding potential risks and preparing proactive adaptive strategies that aim at ensuring a sustainable, equitable, and climate-resilient environment for Malawi. This aligns with Malawi’s long-term national development plan, the Malawi Agenda 2063, which emphasises the importance of integrating environmental sustainability into the national development plans. The Malawi Agenda 2063 seeks to achieve a future in which the country’s natural resources continue to support economic growth, social development, and environmental well-being, ultimately ensuring a prosperous future for all its citizens.

### Scenario Building for the current NSEOR



**Figure 10.2:** Scenario building results

From Figure 10.2, the Business as Usual scenario represents the business-as-usual scenario, which is characterised by weak governance, high population growth, minimal investments in sustainable practices, and ongoing environmental degradation that threatens resilience (Chirombo 2024; Grace 2025). According

to the National Planning Commission (NPC), if the future continues under the “business as usual” path, it will be characterised by huge debts due to high government expenditure and high donor dependence as Figure 10.3 shows.

The Policy First scenario demonstrates a situation where the country is good at policy formulation and reforms but struggles to translate these into sustainable development (Grace 2025; Tambulasi 2010). Projections by the National Statistical Office (NSO) (2019) further characterise the Policy First scenario whereby more than half of the country's population remains ensnared in poverty despite

the two decades of policies aimed at alleviating poverty (Machira *et al.* 2023; Mussa 2017; UNCTAD 2023). The Policy First scenario is further characterised by policy failure due to lack of concrete action, coordination, ineffective oversight, and the politicisation of programmes such as Malawi Agenda 2063 and the Malawi Poverty Reduction Strategy.

### Trends in grants and government budget

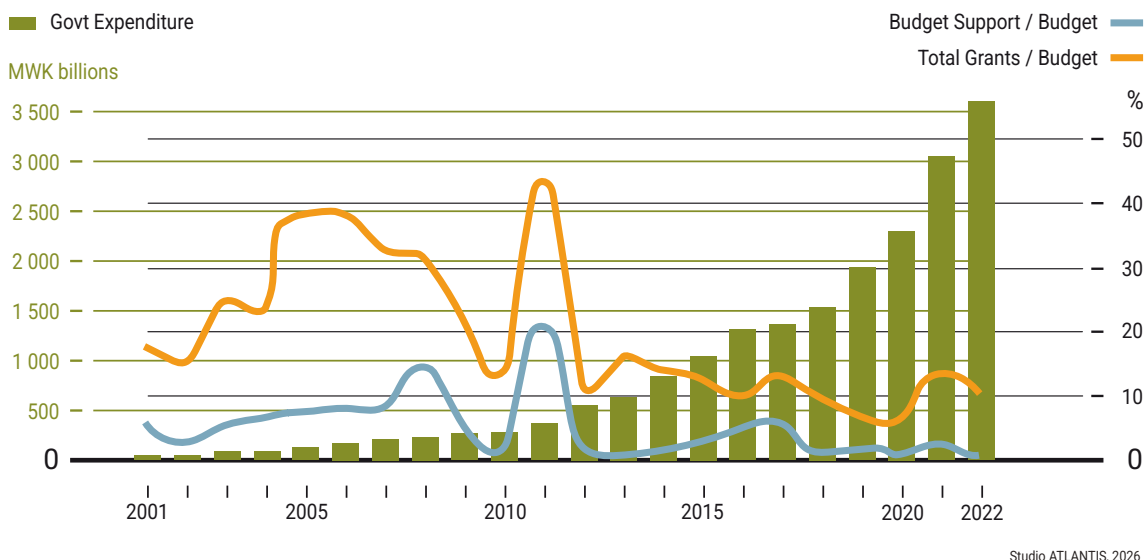


Figure 10.3: Trends in grants and government budget in Malawi (Grace 2025).

The Business as Usual scenario envisages a future in which the targets sought under Malawi Agenda 2063 to transform the country into an upper-middle-income are achievable. This aspirational scenario will be enabled by positive mindset change, effective governance systems and institutions, improved public sector performance, private sector dynamism, human capital development, economic infrastructure, and environmental sustainability. Achieving this goal requires strengthening and sustaining efforts to foster high economic growth at annual rates above 6.2 per cent.

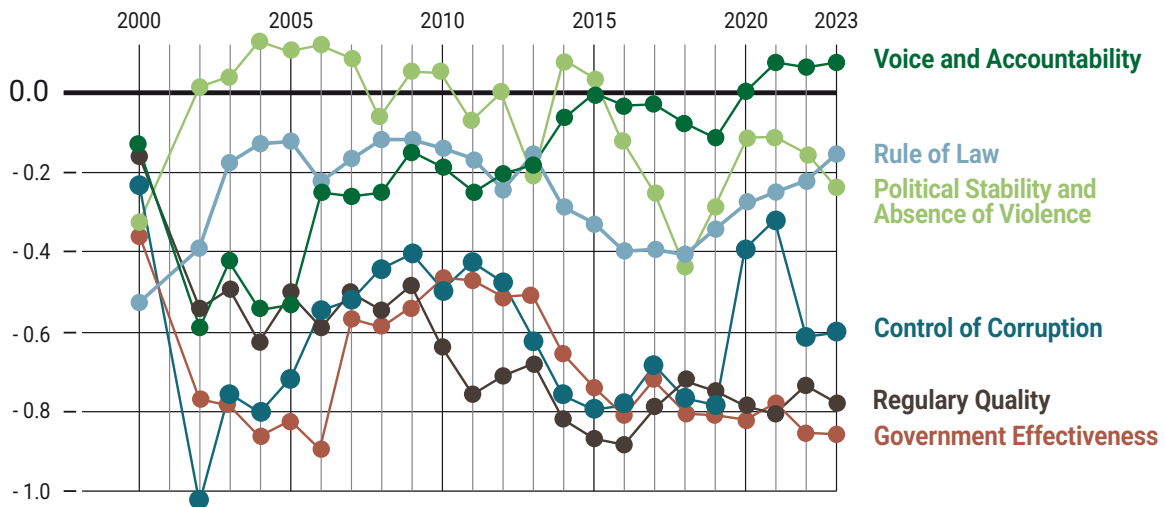
The World Bank flags governance as a foundation for many critical uncertainties, including economic growth, climate initiatives, and social stability. Based on World Bank data<sup>1</sup>, there are indications that most governance indicators reflect sluggish progress (Figure 10.4) despite the good performance on policies as expected under the Policy First scenario. Although the rule of law has shown some improvement, Malawi's legal system has historically been weak (WJP 2023). Accountability has improved marginally but remains inconsistent (Kanyongolo 2013). These unpredictable trends highlight the importance of selecting governance as a key uncertainty, hence the strong need for improved governance and institutions under the Target Seeking scenario.

1 <https://databank.worldbank.org/reports.aspx?source=world-development-indicators#>

## Governance indicators

Standard normal scores, standard deviations  
Range (-2.5 to +2.5)

Estimates



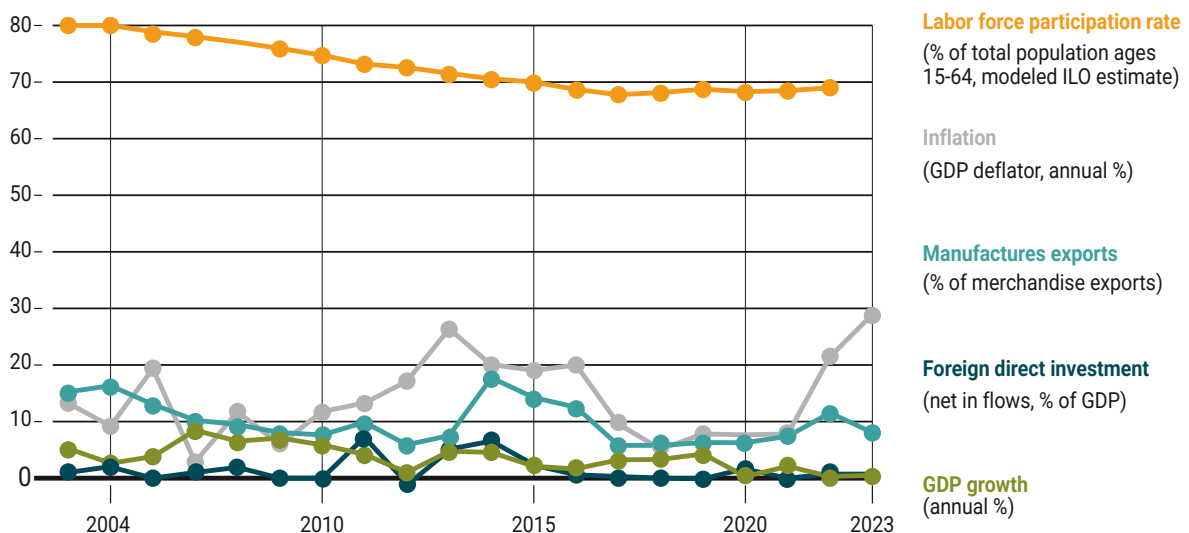
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**Figure 10.4:** Governance indicators of Malawi before and after 2020 (World Bank 2024).

Economic indicators present a mixed picture characterised by phases of growth and challenges. A decline in foreign direct investment, high inflation rates, sluggish GDP growth, and a drop in exports highlight the weak state of Malawi's economy. These factors underscore

the necessity of prioritising economic development as a critical uncertainty for Malawi's future state of the environment (Figure 10.5). It is important to focus on economic development for better environmental performance in both the short- and long term.

## Economic outlook indicators



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**Figure 10.5:** Economic outlook indicators of Malawi before and after 2020 (World Bank 2024).

## 10.3 Scenario 1 - Business as Usual

Malawi's future is characterised by poor economic performance, with high inflation and sporadic shortage of basic goods such as fuel. As such, the nation faces both sluggish economic development and governance challenges. It is expected that there will be fierce competition for the country's increasingly depleted and overused resources on land, freshwater, biodiversity, and energy.

### 10.3.1 Land, soil, and mining

The 2002 Land Policy Act identifies significant environmental consequences of unregulated mining operations (MoL 2002), with a high risk of waterborne diseases and a decrease in agricultural productivity due to dependency on shrinking arable land, degradation of fertile land, and desertification. Inadequate land indirectly exacerbates food insecurity and worsens socioeconomic livelihood. On the other hand, land use and land cover in Malawi have undergone significant transformations over the past three decades, largely driven by population growth, agricultural expansion, and deforestation. Between 1990 and 2010, cropland area increased from approximately 5.77 million hectares to 5.92 million hectares, while forest land declined from 2.64 million to 2.41 million hectares, reflecting increasing pressure on forest resources for cultivation and firewood (FAO 2016). Similarly, grassland and wetland areas have decreased over time, with wetlands shrinking from about 3.02 million hectares in 1990 to 2.36 million hectares in 2010 (Government of Malawi 2011). More recent assessments indicate that this trend has continued, with forest cover further declining to roughly 2.28 million hectares by 2022, accompanied by an expansion in settlements and cropland (Chimwala *et al.* 2023). These changes underscore Malawi's ongoing challenge of balancing agricultural productivity, urbanisation, and environmental sustainability in the context of a growing population and climate variability.

### 10.3.2 Key factors contributing to degradation

- **Deforestation at scale:** Large-scale clearing of forests for firewood, charcoal production, and subsistence farming is a dominant driver; it remains unchecked, leading to loss of critical forest cover and ecosystem services and exposing large tracts of land to erosion and desertification.
- **Unregulated agricultural expansion:** Rapid conversion of marginal lands to agricultural use without sustainable practices accelerates soil fertility loss, rendering vast areas unproductive.
- **Climate change and variability:** Rising temperatures, erratic rainfall patterns, and increased frequency of extreme weather events amplify the vulnerability of land to degradation.
- **Weak governance and policy inertia:** Lack of coordination among government stakeholders, weak land tenure systems, and insufficient policy enforcement result in fragmented and ineffective land management.
- **Population and livelihood pressure:** Population growth exacerbates resource demands, resulting in overexploitation and misuse of land resources.

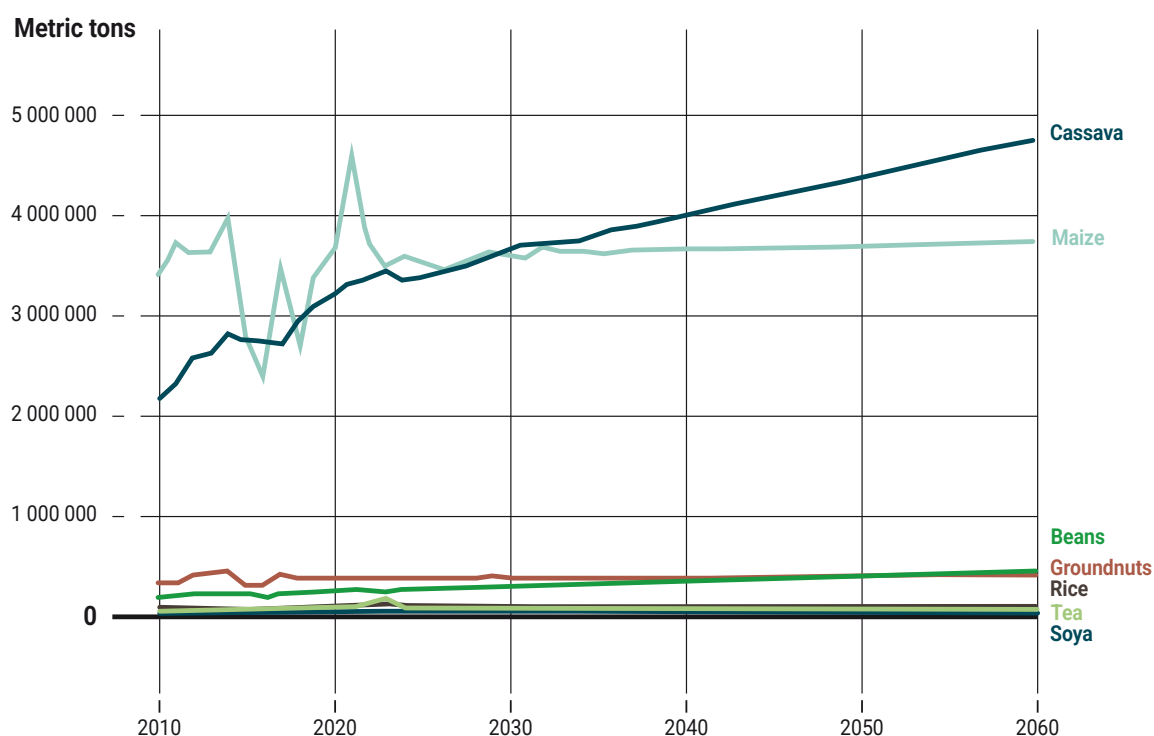
### 10.3.3 Projected impacts by 2050

**Loss of agricultural land:** With 2.4 million hectares degraded, Malawi risks losing substantial portions of its productive land, directly threatening food security and economic stability. Figure 10.6 presents the different crop production trends in Malawi from 2010 to 2060. The forecast for trends shows a flat and stable pattern across six crops beyond 2024, suggesting that production is expected to remain constant if the country continues to lack major policy implementation, technological advancements, and zero efforts in climate adaptation. This will cause low agricultural productivity that will exacerbate food insecurity and continued vulnerability to shocks.



Climate change and variability are major drivers of Malawi's future state of the environment. Photo: Matthews Malata

## Crop production trends



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**Figure 10.6:** Crop production trends (FAO 2024).

If Malawi continues down this path without structural changes, policy shifts, or technological advancements, the agricultural sector may fail to support long-term economic and food security needs as the shortage between food

supply and demand may continue to increase with respect to population growth. The situation will be worsened by projected large-scale soil erosion and sedimentation of water bodies as shown in Table 10.1.

**Table 10.1:** Annual soil erosion and sedimentation projections under the Business as Usual scenario

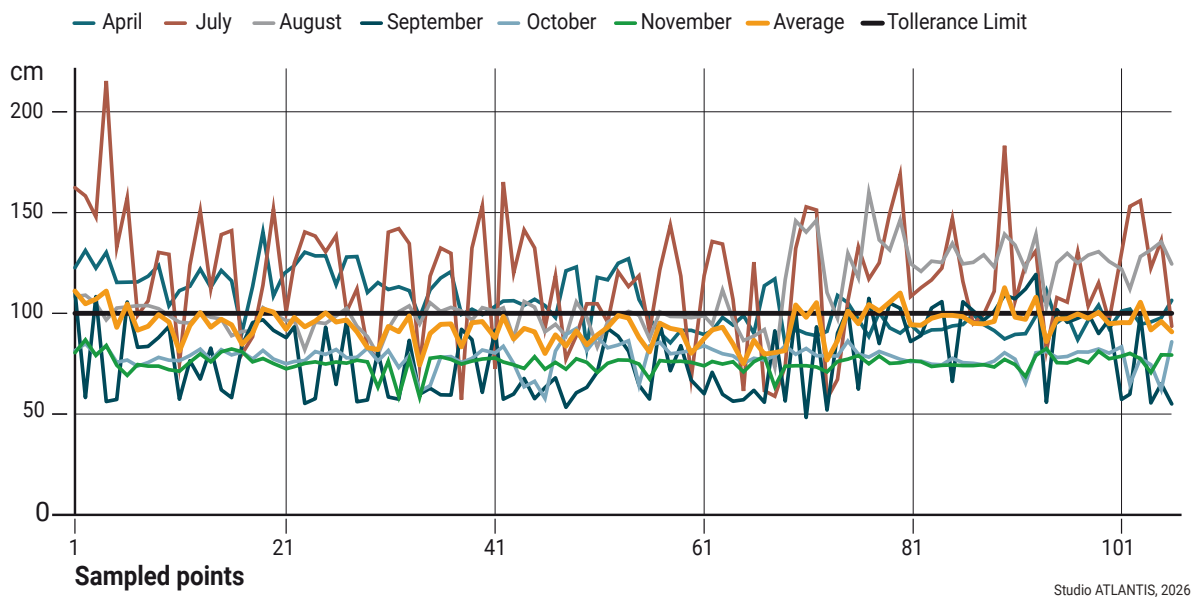
Summary: Sedimentation under Business as usual scenario	
Output	Range of mean annual erosion in croplands (t/ha/yr)
Results by 2050	37 – 42
Output	Range of annual sedimentation in reservoirs (Million t/yr)
Results by 2050	3.7 – 4.7

### 10.3.4 Biodiversity

Deforestation and unregulated resource extraction destroy habitats and affect biodiversity. Once these habitats are destroyed there is a likelihood of zoonotic diseases that can threaten public health. Concurrently, a reduction in biodiversity, especially soil organisms (e.g., microbes, fungi, earthworms) can affect food production as these organisms help in decomposition of organic matter, recycle nutrients, and maintain soil structure.

Biodiversity in aquatic systems will be affected by levels of pollution (water quality) in the water bodies. Figure 10.7 shows that Secchi Disk Depth levels (indicator of how much sunlight passes through a column of water) is erratic over selected months, with direct implication on the growth of plankton in the water body, which is a source of food for various species in water.

### Spatial-temporal trends for Secchi Disk Depth within an urban aquatic system Business as usual scenario, 2024



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**Figure 10.7:** Spatial-temporal trends for Secchi Disk Depth within an urban aquatic system under the Business as Usual scenario (Department of Land Surveys 2024a).

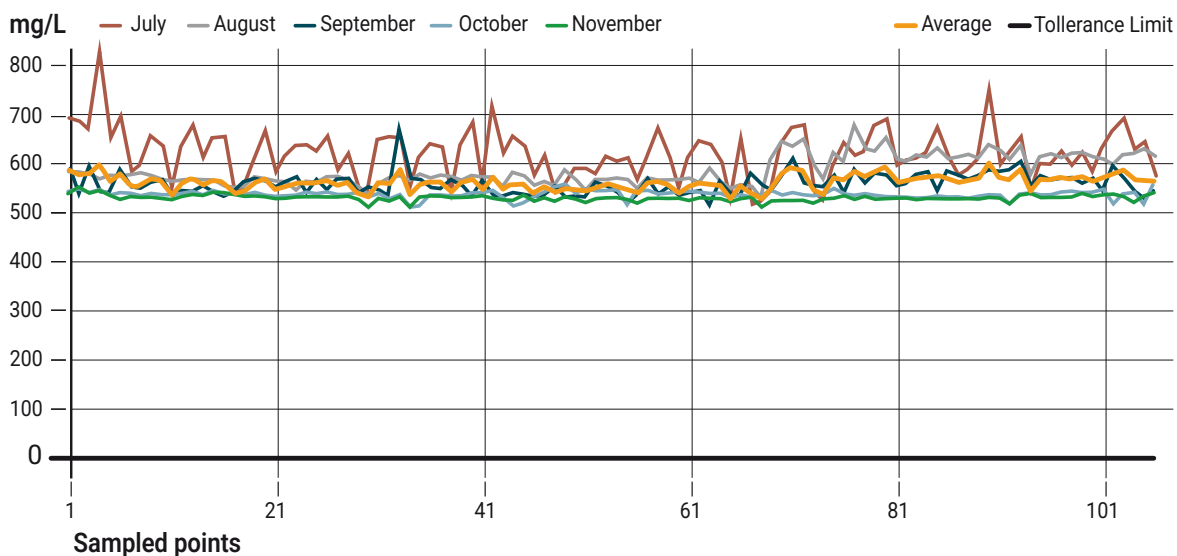


**Malawi’s over reliance on biofuels for energy is a major pressure on forests. Photo Government of Malawi**

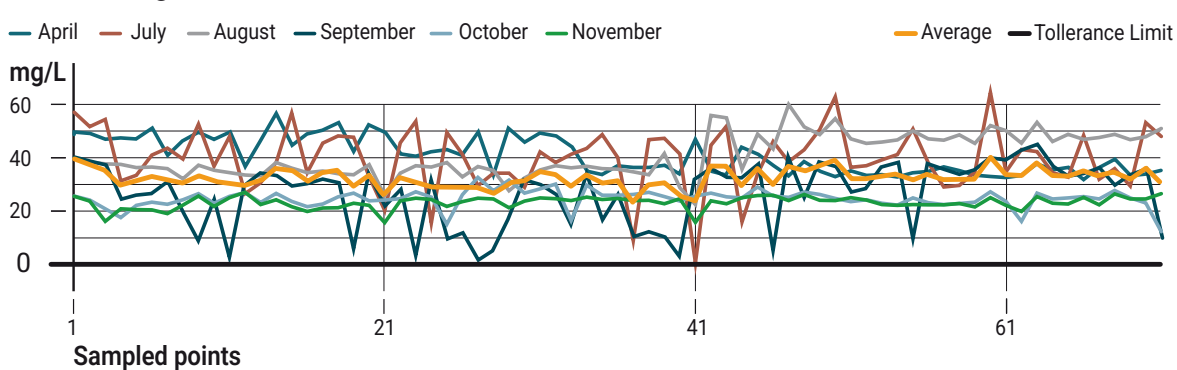
As Figure 10.8 shows, both spatial and temporal variations of suspended solids and nutrients surpass the tolerable values, a situation that will persist under Business as Usual. This has a direct implication for biodiversity in aquatic systems.

## Spatial-Temporal Trends 2024

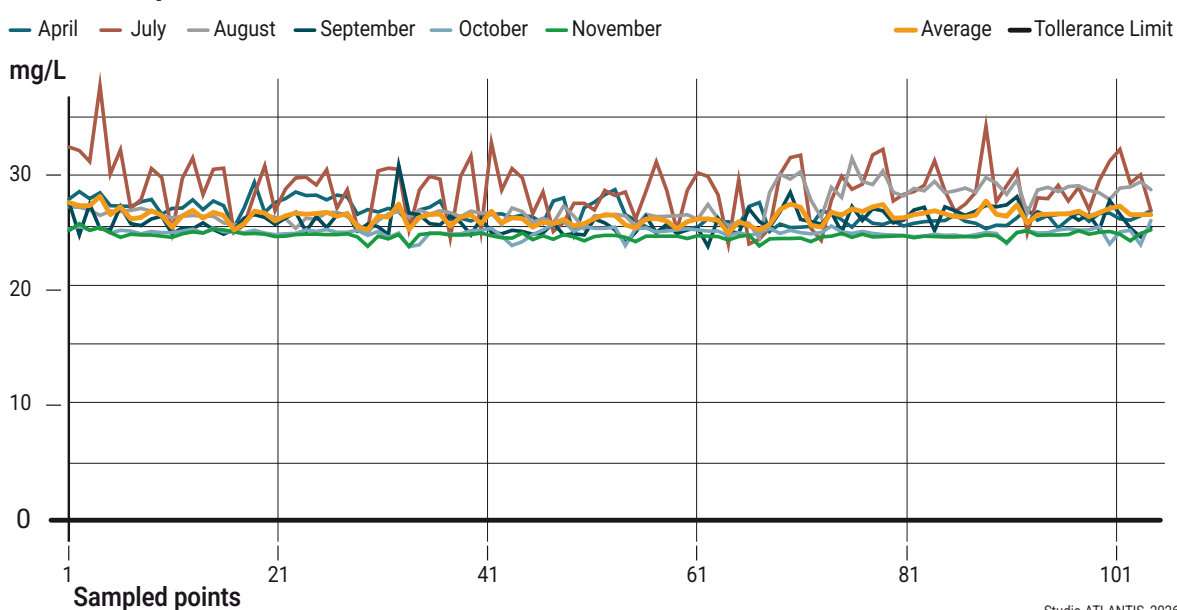
### Total Suspended Solids



### Total Nitrogen



### Total Phosphorus



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**Figure 10.8:** Spatial-temporal trends for (a) Total Suspended Solids, (b) Total Nitrogen, and (c) Total Phosphorous content in an urban aquatic system under Business as Usual. (Department of Land Surveys Malawi 2024b).

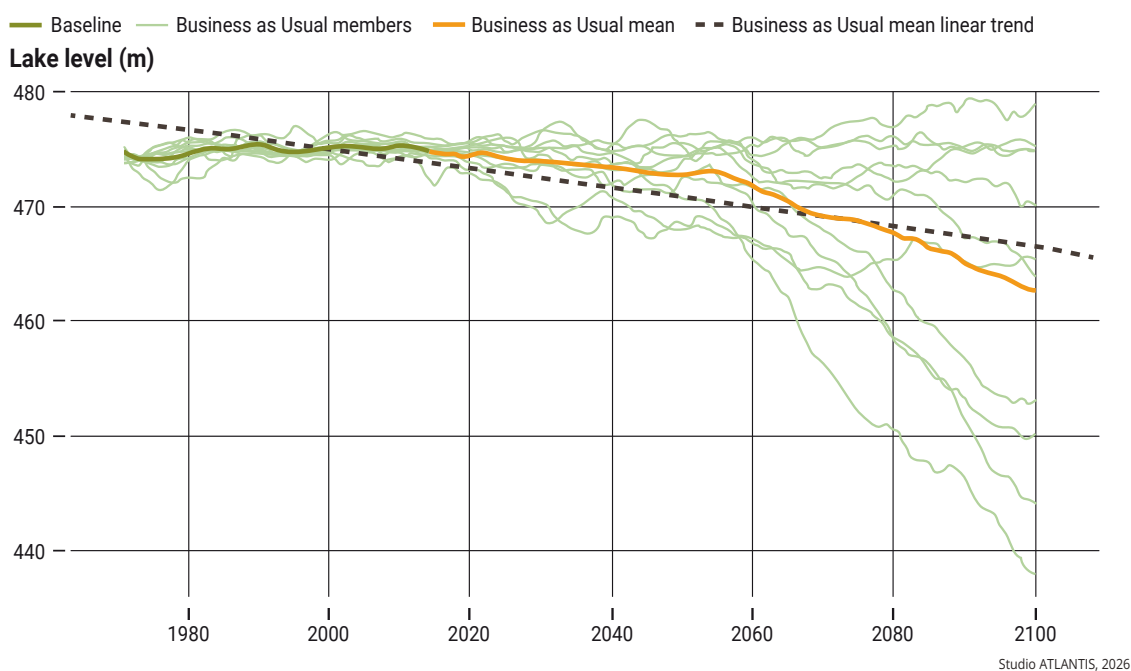
## 10.3.5 Freshwater

### 10.3.5.1 Lake level projections

The historical baseline from 1971 to 2014 indicates relatively stable average lake levels of around 475

meters. However, future projections under the Business as Usual scenario suggest a significant downward trend. Forecasts show drastic declines in lake levels, potentially falling below 450 meters by the year 2100 as depicted in Figure 10.9.

#### Projections of water levels in Malawi beyond 2060 Business as Usual Scenario



**Figure 10.9:** Projections of water levels in Malawi beyond 2060 under the Business as Usual scenario (DCCMS Database 2024a)

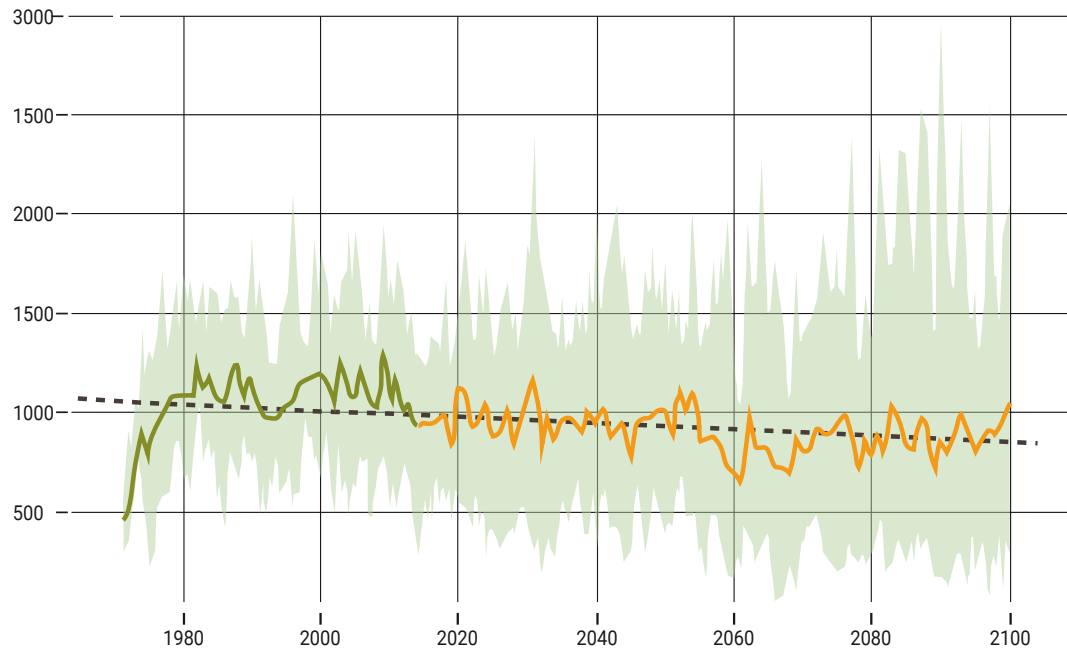
A significant reduction in water availability is likely to lead to severe water stress and scarcity, affecting both urban and rural communities. Agriculture that heavily depends on lake-sourced irrigation will face substantial challenges, and food security will be threatened. The fisheries sector, a vital source of income for lakeshore communities and a source of nutrition for most Malawians, is also at risk due to habitat disruption and reduced fish stocks. Diminished outflows from the lakes could severely impact hydropower generation, undermining national energy security. Water transport, essential for connectivity and trade across the lake, may be disrupted, while the degradation of lake ecosystems would have cascading effects on biodiversity, tourism, and the overall environmental health of the country and its neighbours.

Projections of inflows into Lake Malawi reveal critical trends with significant implications for the lake's hydrological balance. The historical baseline period from 1971 to 2014 shows a relatively stable inflow pattern, with an average discharge of approximately 1,000 cubic meters per second, sustaining the lake's levels and supporting a range of ecological and socio-economic functions. The future climate and hydrological projections under the Business as Usual scenario suggest a general decline in inflow, signalling potential stress on the lake's ability to maintain current levels. As shown in Figure 10.10 a gradual but persistent decrease in inflow is expected for Lake Malawi across the 21st century, raising concerns over the long-term sustainability of water resources, ecosystem integrity, and human activities dependent on Lake Malawi.

## Projections of inflows of Lake Malawi beyond 2060 Business as Usual Scenario

— Baseline (1971-2014) — Business as Usual members — Business as Usual mean - - Business as Usual mean linear trend

Water flow (m<sup>3</sup>/s)



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**Figure 10.10:** Projections of inflows of Lake Malawi beyond 2060 under Business as Usual scenario (DCCMS Database 2024b)

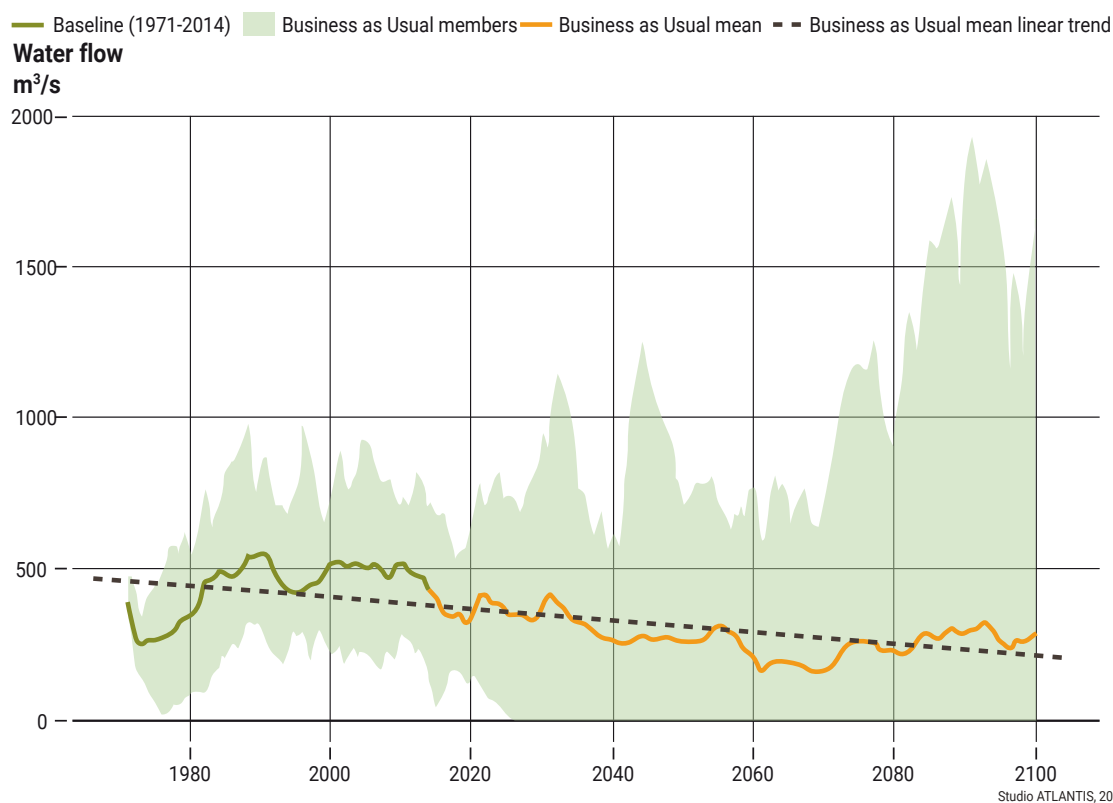
The current outflow from Lake Malawi shows a relatively stable outflow pattern, with average discharge rates around 500 cubic meters per second, primarily through the Shire River. This consistent outflow has historically supported downstream ecosystems, agricultural activities,

and hydropower generation. Future climate projections indicate a general decline in outflow (Figure 10.11), raising concerns over the long-term sustainability of these vital functions.



Green energy solutions are needed to meet Malawi's growing demand for electricity. Photo: Sadhika Sasiprabhu.

## Projections of water outflows from Lake Malawi beyond 2060 Business as Usual scenario



**Figure 10.11:** Projections of water outflows from Lake Malawi beyond 2060 under Business as Usual scenario (DCCMS Database 2024c)

The projected decline in outflow from Lake Malawi presents a series of serious national implications, particularly for downstream communities that are heavily reliant on consistent water flow from the lake via the Shire River. A reduction in water availability could significantly affect communities, agriculture, and industries that depend on this vital resource, leading to increased competition and potential conflicts over water use. One of the most immediate and critical impacts would be on hydropower generation, as facilities such as Nkula, Tedzani, and Kapichira rely on stable flows from the Shire River to meet a substantial portion of Malawi's electricity demand. A decrease in outflow could reduce power generation capacity, undermining energy security and economic growth. Additionally, aquatic ecosystems downstream are likely to suffer, with lower water volumes affecting water quality, habitat availability, and the survival of sensitive species, ultimately reducing biodiversity. Economic activities such as irrigation, farming, fisheries, and water-dependent industries may also face severe disruptions, threatening livelihoods, and national development goals.

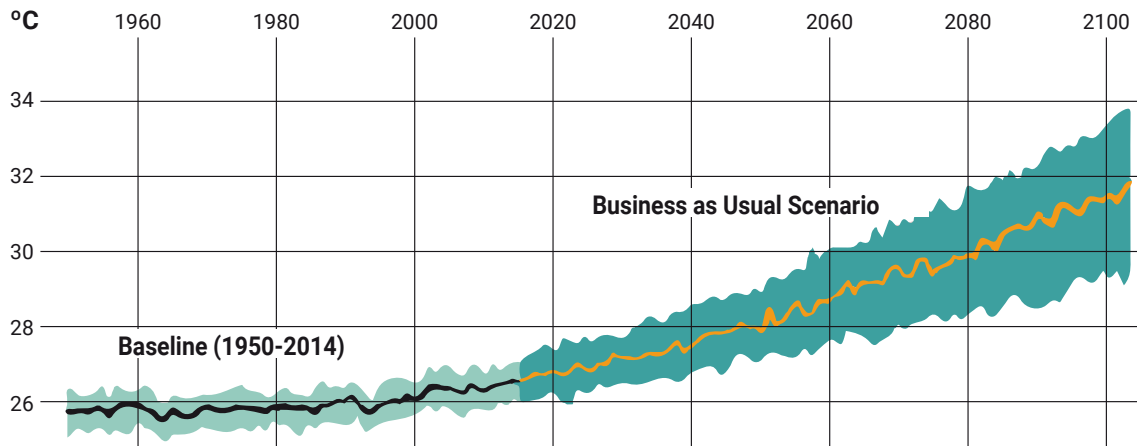
## 10.4 Air and climate

Malawi has been grappling with the impacts of climate change for some time, including rising temperatures, erratic rainfall patterns, as well as frequent and intense droughts and floods. Projections indicate that average temperatures could rise by up to 3°C by 2050, while rainfall is expected to decline by 4 percent per decade. The country is likely to face more frequent and intense droughts and floods in the coming years (DCCMS 2022).

### 10.4.1 Maximum temperature

A warming trend emerges for Malawi. Under the Business as Usual scenario, the maximum temperature is projected to rise steadily throughout the 21st century, surpassing 30°C by mid-century and approaching 34°C by 2100 as depicted in Figure 10.12.

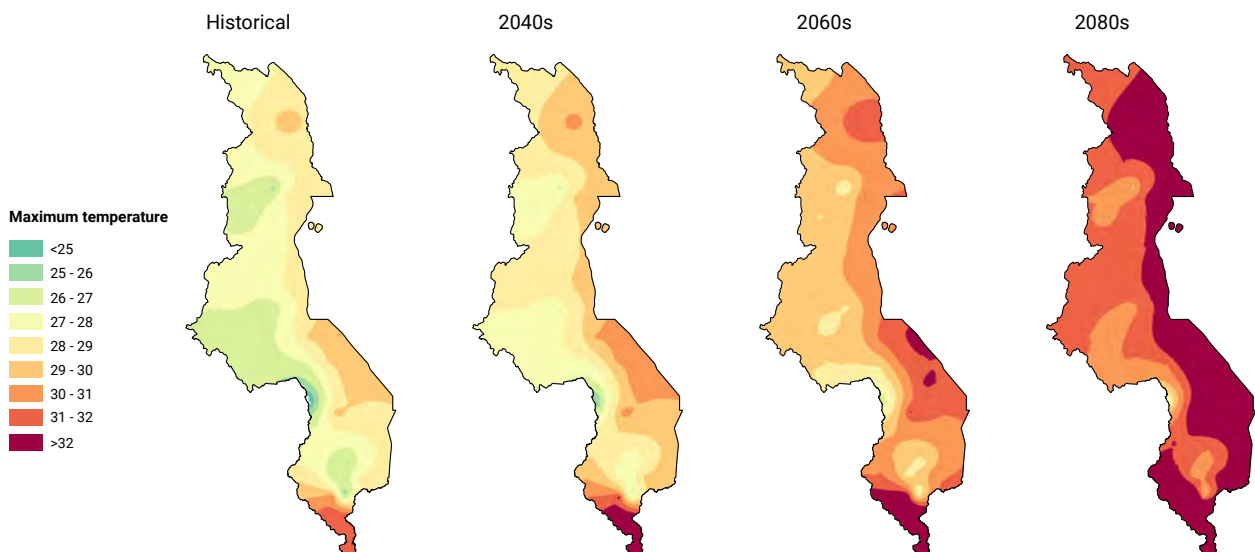
**Projected Average Maximum Temperature for Malawi  
Business as Usual Scenario  
Multi-Model Ensemble**



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**Figure 10.12:** Projected Average Maximum Temperature for Malawi under the Business as Usual scenario, Multi-Model Ensemble (World Bank 2022)

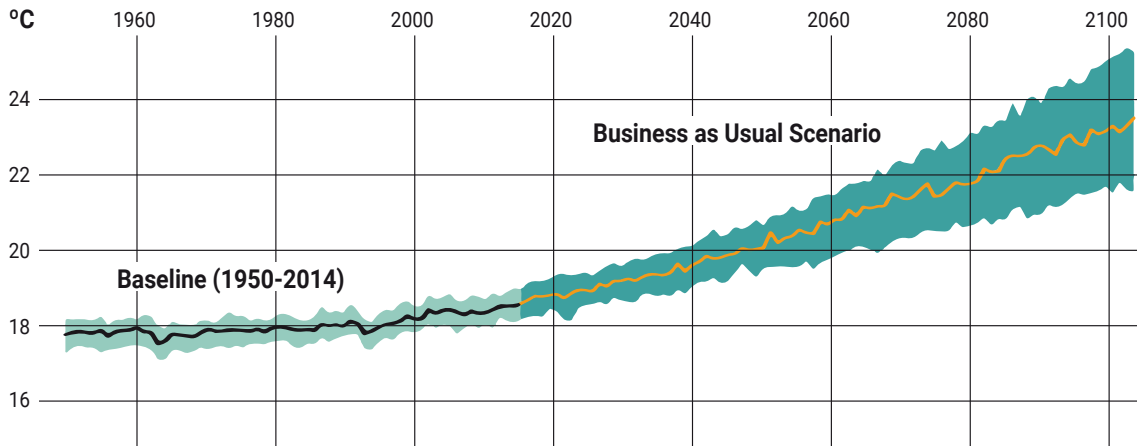
As shown in Figure 10.13 Malawi’s regions will be affected differently by the predicted temperature rise, with the Shire Valley recording the highest average temperature.



**Figure 10.13:** The ensemble maximum temperature from 2020s (historical period) to 2040s, 2060s and 2080s for the Business as Usual scenario (DCCMS database 2024d)

The minimum temperatures are also expected to increase, surpassing 22°C by mid-century and approaching 24°C by 2100 as shown in Figure 10.14.

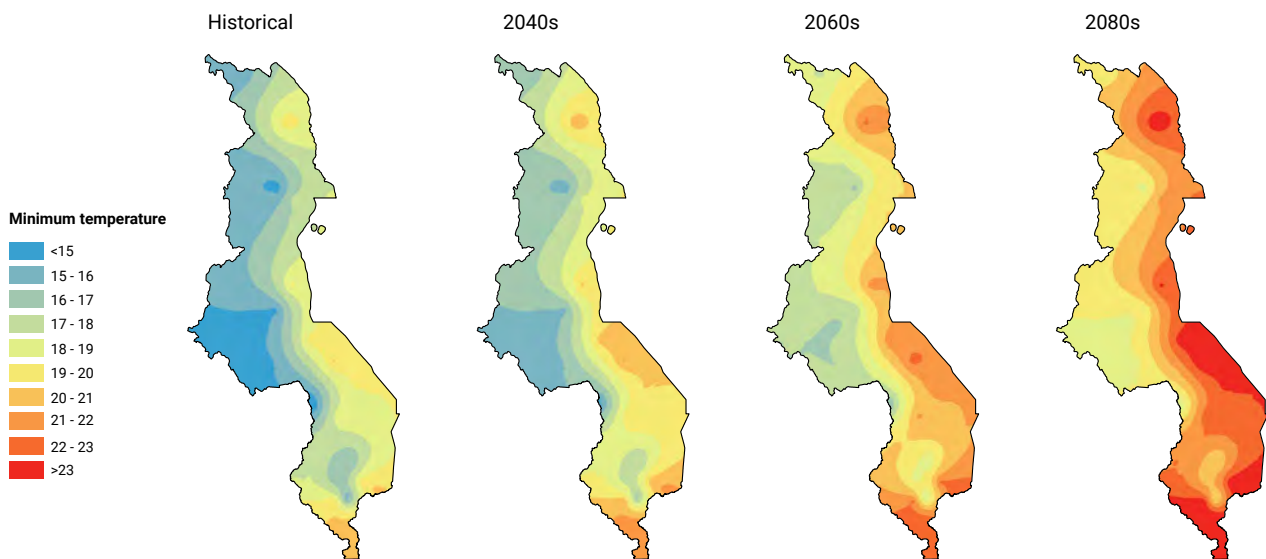
**Projected Average Minimum Temperature for Malawi  
Business as Usual Scenario  
Multi-Model Ensemble**



Studio ATLANTIS, 2026

**Figure 10.14:** Projected Average Minimum Temperature for Malawi under Business as Usual scenario, Multi-Model Ensemble (World Bank 2022)

The warmest regions in the country include Shire Valley, Machinga, Salima, and Karonga, while the coldest areas are Lilongwe, Kasungu, and Mzuzu (Figure 10.15).



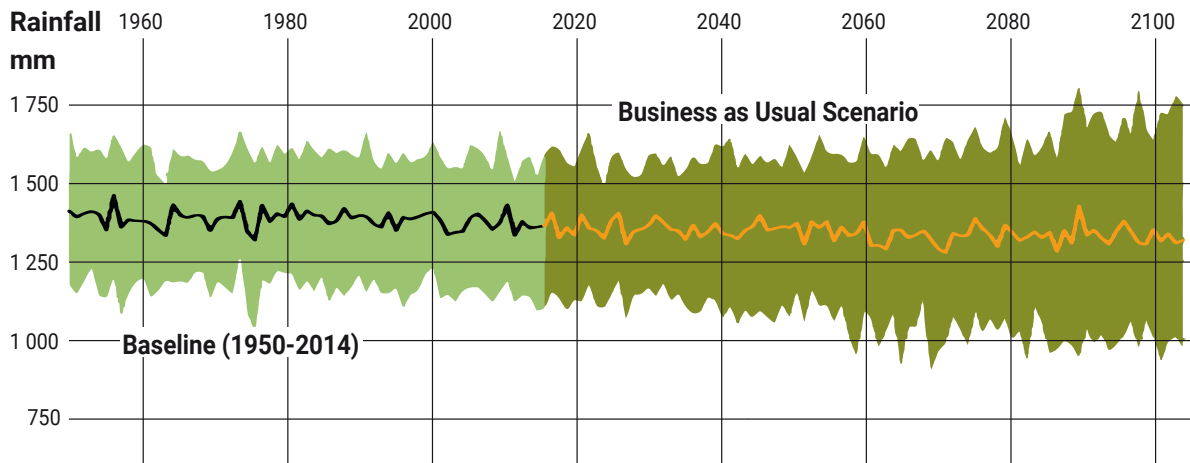
**Figure 10.15:** The ensemble minimum temperature from 2020s (historical period) to 2040s, 2060s and 2080s for the Business as Usual scenario (DCCMS 2024e)

### 10.4.2 Rainfall

From 2030 onwards, rainfall continues to exhibit significant variability, with no clear sign of an increasing or a decreasing trend. The projected rainfall remains within a range of approximately 1,250 mm to 1,500 mm as

depicted in Figure 10.16, although the uncertainty range expands considerably after 2050, suggesting increased variability and potential for extreme events.

#### Projected Precipitation for Malawi Business as Usual Scenario Multi-Model Ensemble

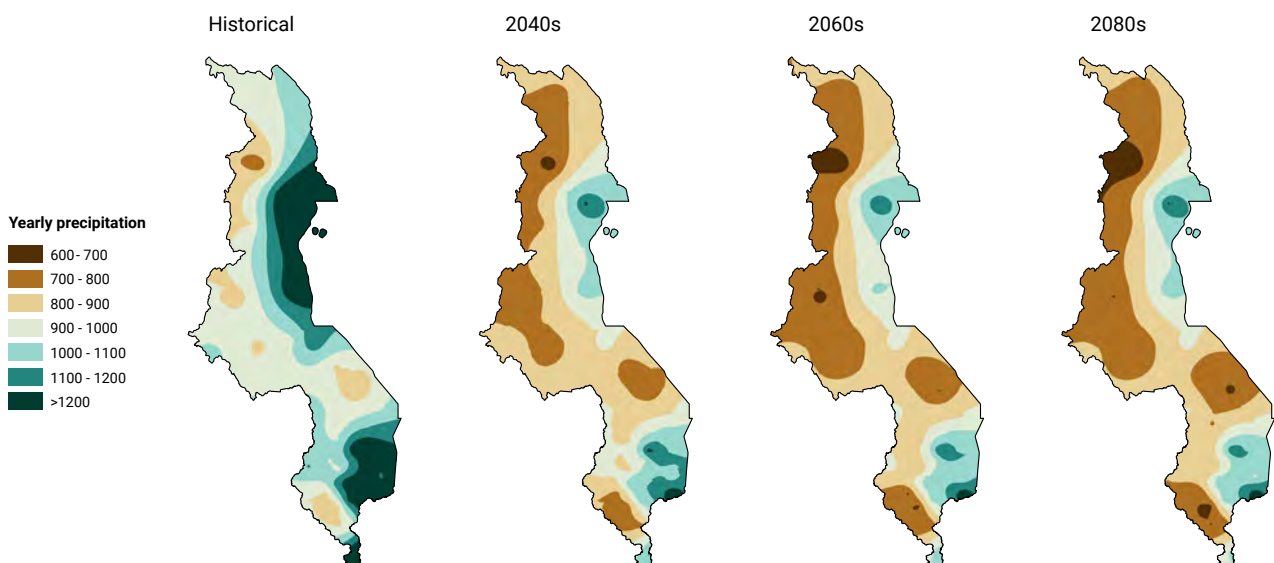


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**Figure 10.16:** Projected precipitation for Malawi under Business as Usual scenario, Multi-Model Ensemble (World Bank 2022).

The wettest areas in the country are concentrated in the northern lakeshore regions, including Mzuzu, Karonga, and Salima, with additional high rainfall areas in Blantyre

and Lilongwe. The driest spots are in northern Mzuzu, Kasungu, Machinga, and Shire Valley (Figure 10.17).



**Figure 10.17:** The ensemble rainfall from 2020s (historical period) to 2040s, 2060s and 2080s for Business as Usual scenario (DCCMS 2024f)

The rising maximum and minimum temperatures contribute to an increase in heat-related illnesses, particularly heat exhaustion and heat stroke. Additionally, warmer temperatures create favourable conditions for the proliferation of vector-borne diseases such as malaria, dengue fever, and cholera, significantly straining public health systems. Climate-induced food insecurity further exacerbates malnutrition, particularly among vulnerable populations such as children, the elderly, and people with preexisting conditions. Poor governance and inadequate healthcare infrastructure limit access to essential medical services and hinder the implementation of adaptive measures such as improved disease surveillance, early warning systems, and community health interventions.

Rising temperatures also lead to an increased demand for cooling energy, placing additional pressure on already fragile power grids, particularly in urban areas. Extreme weather events, such as floods and droughts, disrupt energy production by damaging power infrastructure, reducing hydroelectric generation capacity, and causing fluctuations in fuel supply chains. Flood-induced sedimentation and debris accumulation in reservoirs lower efficiency, while droughts reduce water availability for hydropower generation. Poor governance and lack of strategic investment in resilient and renewable energy systems further exacerbate energy supply vulnerabilities, leading to frequent blackouts and economic losses.

Extreme weather events, including floods and heat waves, would severely damage transportation infrastructure, leading to road and railway washouts, bridge collapses, and disruptions in mobility. Persistent flooding and erosion weaken roads, making them more susceptible to damage. Additionally, high temperatures cause railway track deformations and asphalt degradation, increasing the frequency of accidents and maintenance costs. Poor governance delays necessary infrastructure maintenance, adaptation, and expansion, hindering economic growth and trade efficiency.

Climate change-induced migration due to extreme weather events, resource scarcity, and declining agricultural yields exacerbate social tensions and increase the risk of conflicts over land and water resources. Unemployment rates rise as economic activities in agriculture, fisheries, and industry suffer from climate disruptions. Weak evacuation plans, lack of alternative livelihood programs, and delayed government interventions amplify vulnerabilities, pushing more households into poverty. Women and marginalized communities bear the brunt of these economic disruptions due to limited access to financial resources and social protection mechanisms.

Erratic rainfall patterns, prolonged dry spells, and increasing temperatures severely impact agricultural productivity, reducing crop yields and escalating food insecurity. Staple crops such as maize, rice, and beans experience significant yield declines, leading to price surges and increased dependence on food imports.

Rising temperatures also affect livestock health, reducing meat and dairy production. Poor governance further exacerbates the situation by failing to implement climate-smart agricultural practices, irrigation infrastructure improvements, and food storage systems. The lack of comprehensive agricultural policies and investment in research and innovation hampers the sector's resilience against climate shocks.

## 10.5 Scenario 2 - Policy First

The *Policy First* scenario envisions a Malawi where governance structures and policies improve significantly, but economic growth remains slow and inconsistent. Despite well-intentioned reforms, limited financial resources, weak private sector investment, and external economic shocks prevent substantial progress in national development. Malawi experiences policy-driven progress in areas like climate governance, environmental protection, and institutional reforms, yet without parallel political commitment, institutional reforms and economic development, these efforts fall short of driving meaningful transformation in livelihoods and overall well-being of Malawians. Land, freshwater, biodiversity, and air quality remain too poor to adequately improve people's lives.

### 10.5.1 Land and soil

The condition of landscapes continues to decline over the years mainly as a result of population densification. Good policies to restore degraded lands are in place but lack enforcement, including the mandatory environmental and social impact assessments for new projects. There is an increased demand for natural resources in the forms of fuelwood and other forest products, agricultural expansion, as well as livestock grazing. While the use of alternative energy sources is promoted, this is not scaled enough to ensure wide use of briquettes, liquified petroleum gas, and biogas in the rural areas. There are plans to increase the land area under irrigation, but old irrigation schemes are not maintained while new initiatives through the Greenbelt Initiative are too small to make a difference. As agricultural land and human settlements are observed to be increasing, there is a decline in land holding. Deforestation, soil loss, as well as misuse of non-forested areas are detrimental to the provision of many important ecosystem services. It is estimated that 85 per cent of land in the country is degraded and requires restoration.

As a result, undistinguished land use practices and regulations under the Policy First scenario will not yield the anticipated results of minimising environmental degradation and boosting economic growth. These practices will only orchestrate the decline of soil fertility where the emphasis is on agricultural expansion rather than focusing on productivity per unit area. It is important to note that soil nutrients are depleted both through erosion caused by deforestation and through the overuse of fertilisers, which leads to soil acidification. Consequently, under the Policy First scenario, achieving

food security and reducing poverty will remain a significant challenge.

### 10.5.2 Biodiversity

A few factors have been identified as being critical to biodiversity sustainability. These factors include but are not limited to overexploitation, habitat destruction, land use change, disuse of disease-resistant traditional crop varieties, invasive and alien species, economic development, hunting, logging, agriculture, and residential and commercial developments. Most of the outlined factors are results of unprecedented population growth, which exerts more pressure on natural resources, coupled with governance issues.

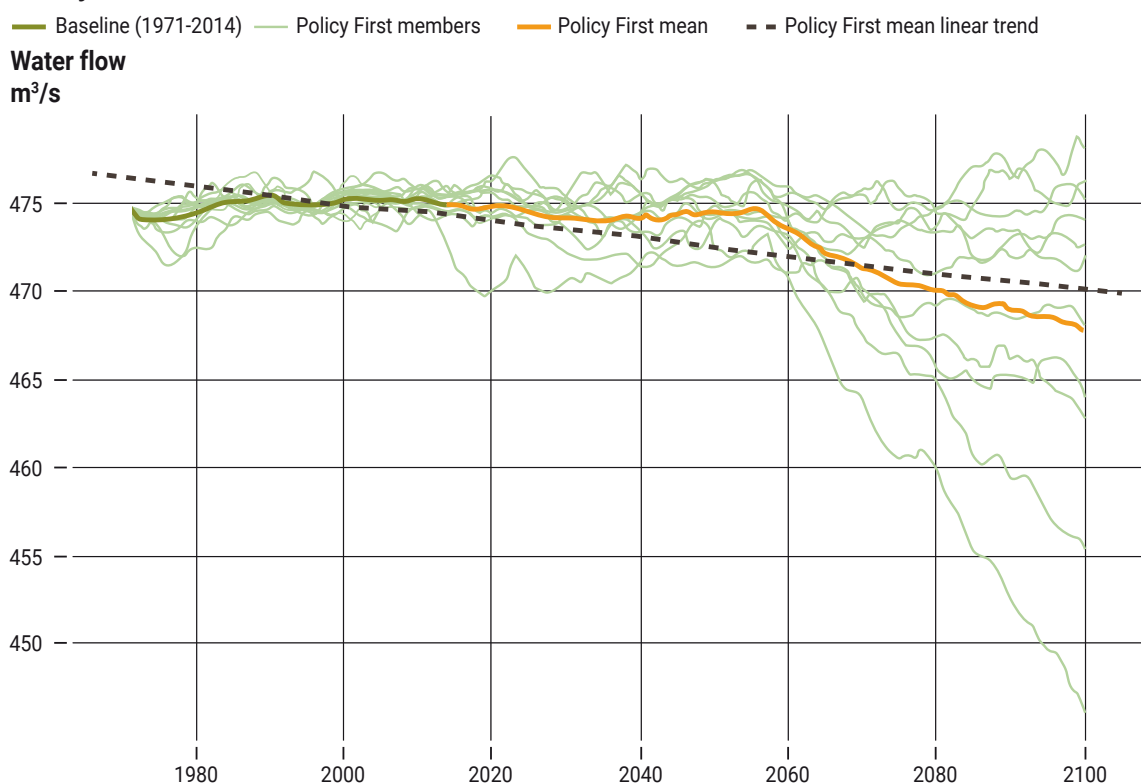
Under the Policy First scenario, some species will thrive whilst others will decline. For instance, minimal investments in safeguarding biodiversity hotspots and

protected areas endangers the survival of some species, especially those that are vulnerable to anthropogenic activities because of unsustainable population growth. Overexploitation is attributed to lack of alternatives for both livelihood and energy sources.

### 10.5.3 Freshwater

Lake outflows, especially for Lake Malawi, decline under the *Policy First* scenario with critical implications for water security and economic activities dependent on lake levels. On this path, Malawi faces a concerning long-term trend of reduced lake outflows with wide-ranging environmental and socio-economic implications. The future projections point to a gradual but persistent decline in lake levels, with the most pronounced reductions occurring in the latter half of the 21st century as shown in Figure 10.18. This trajectory raises alarm over the lake's ability to support critical services under changing climate conditions.

## Projections of water levels in Malawi beyond 2060 Policy First scenario



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**Figure 10.18:** Projections of water levels in Malawi beyond 2060 under Policy First scenario (DCCMS Database 2024g)

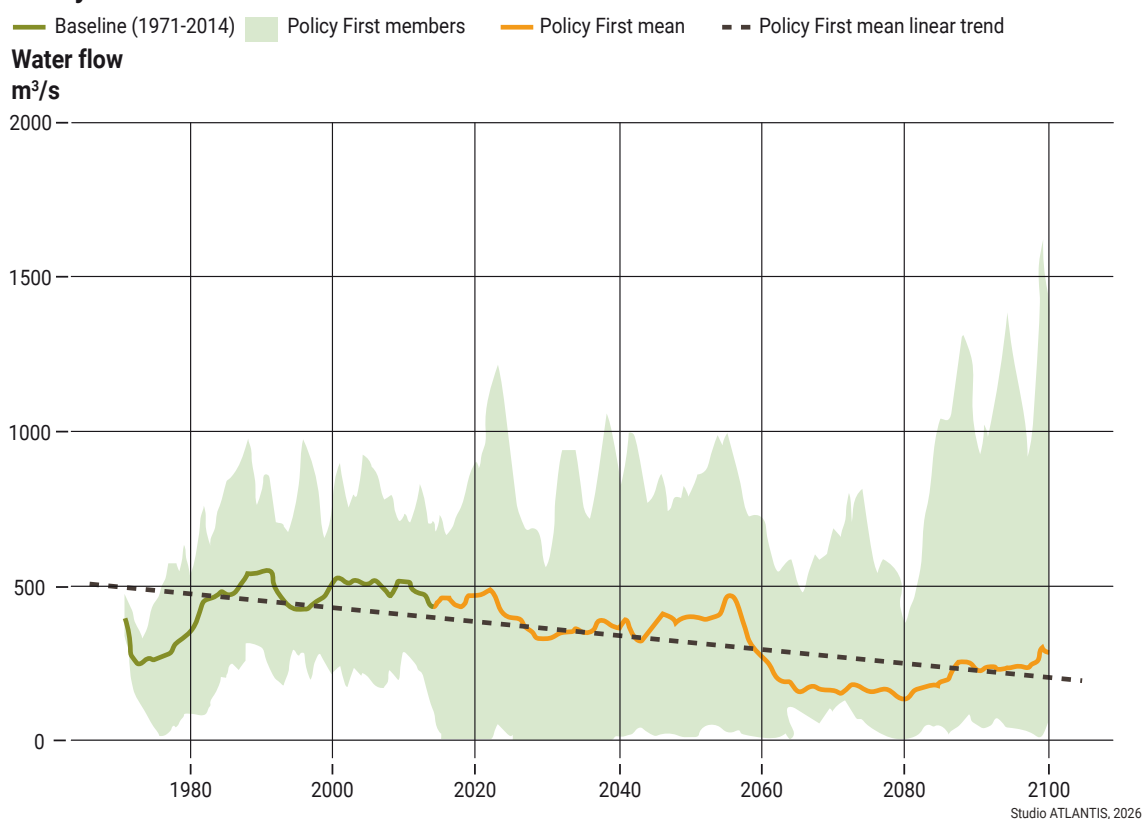
The projected decline in Lake Malawi's water levels carries significant national implications, particularly in the context of sustainable development and climate resilience. A continued downward trend in lake levels is likely to exacerbate water stress across various sectors, placing additional strain on already vulnerable communities and ecosystems. For the agricultural sector, which is heavily

dependent on reliable water sources for irrigation, these changes pose serious challenges to achieving national food security and development goals. Similarly, while Malawi has made commendable strides in formulating sustainable fisheries policies, declining water levels threaten to undermine these efforts by disrupting aquatic habitats and reducing fish stocks. Hydropower generation,

largely reliant on the lake and the Shire River, also stands at risk, with falling lake levels affecting energy production and overall power system stability. The ecological integrity of Lake Malawi, one of the world's most important freshwater biodiversity hotspots, will face mounting pressure, potentially leading to irreversible environmental degradation. These trends underscore the urgent need for the effective implementation of climate adaptation and water resource management policies to safeguard national interests and build long-term resilience.

Lake Malawi inflow projections reveal a concerning trajectory, with important implications for the lake's hydrological stability and the broader water resource system. Future climate projections suggest a general decline in inflow throughout the 21st century, raising alarms about the sustainability of water inputs needed to maintain lake levels and support dependent ecosystems and livelihoods. While individual model outputs exhibit considerable variability, highlighting the complexity and uncertainty inherent in hydrological forecasting, the overall ensemble mean points to a slight but persistent downward trend as shown in Figure 10.19.

### Projections of inflows Malawi beyond 2060 Policy First scenario



**Figure 10.19:** Projections of inflows Malawi beyond 2060 under Policy First scenario (DCCMS Database 2024)

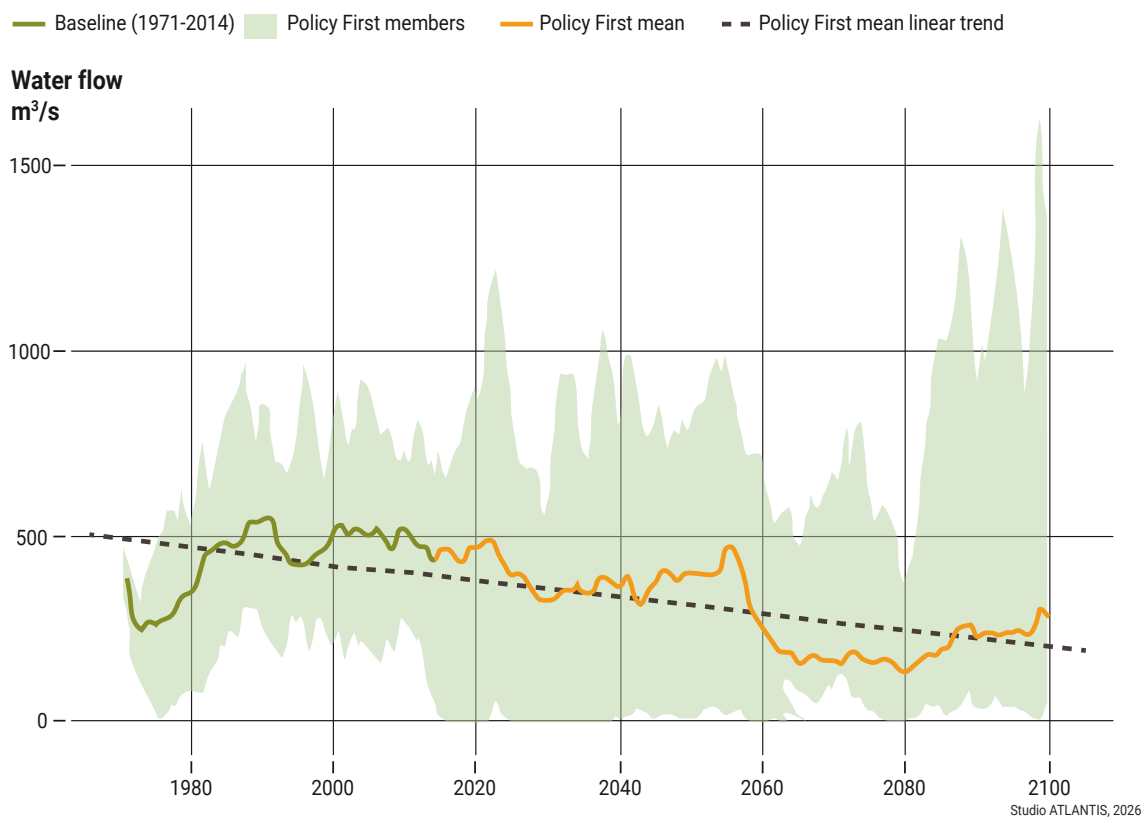
The projected decline in inflow to Lake Malawi carries significant national implications, particularly in the context of water security, environmental sustainability, and agricultural productivity. Reduced water availability within the lake system could lead to a sustained drop in lake levels, intensifying pressure on an already delicate hydrological balance. Such changes would have direct consequences for the ecological integrity of Lake Malawi, one of the most biologically diverse freshwater lakes in the world, potentially disrupting habitats, altering species composition, and reducing overall biodiversity. These ecological shifts could have a further impact on

the livelihoods of communities that rely on fishing and ecosystem services provided by the lake. Diminished inflow would constrain the availability of water for agricultural use, particularly irrigation-dependent farming systems along the lakeshore and within adjacent catchments. This poses a threat to national food security, rural livelihoods, and the broader goal of achieving sustainable agricultural development. These projections underscore the urgency of implementing integrated water resource management strategies and climate adaptation measures to mitigate the long-term impacts of declining lake inflows on Malawi's development trajectory.

Under the Policy First scenario, projections for Lake Malawi's outflow indicate a general declining trend, which is more moderate compared to the Business as Usual scenario as depicted in Figure 10.20. This trend is caused

for concern as it signals a gradual reduction in the volume of water flowing from the lake to the Shire River, which is a critical waterway for Malawi's energy, agriculture, and ecosystems.

### Projections of water outflows from Lake Malawi beyond 2060 Policy First Scenario



**Figure 10.20:** Projections of water outflows from Lake Malawi beyond 2060 under Policy First scenario (DCCMS Database 2024)

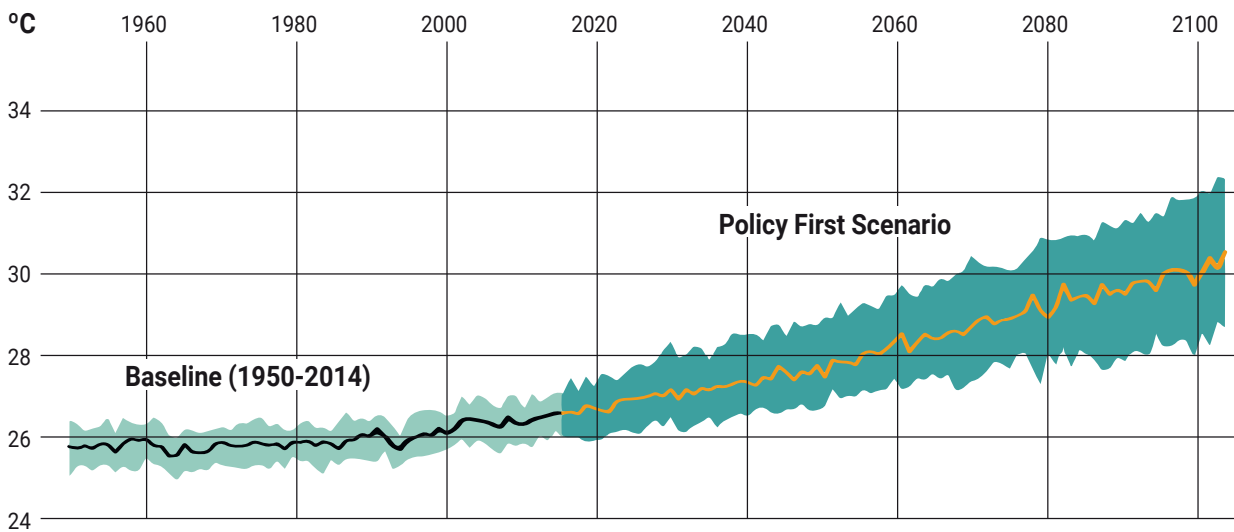
Nationally, this anticipated decline in outflow could lead to reduced water availability downstream, though the impacts may unfold less abruptly than in the more extreme Business as Usual scenarios. Nevertheless, even a moderate reduction can present challenges for hydropower generation, particularly in sustaining consistent electricity production at key facilities at Nkula, Tedzani and Kapichira. Additionally, changes in flow regimes may disrupt the ecological balance of the Shire River, affecting aquatic biodiversity and water quality. Economic activities such as irrigation, fishing, and industrial operations that rely on consistent water flow, may also experience some level of disruption. These projections underscore the need for proactive and effective implementation of water management and climate adaptation policies to ensure resilience and long-term sustainability across sectors dependent on Lake Malawi's outflow.

#### 10.5.4 Air and climate

The maximum temperatures are projected to rise at an accelerating rate, surpassing 30°C by mid-century and exceeding 32°C by the late 21st century under the Policy First scenario. The shaded uncertainty broadens over time, indicating increasing climate variability and the possibility of more frequent and intense heat waves (Figure 10.21).

This rapid increase in maximum temperatures suggests that Malawi would experience more frequent extreme heat events, with potential temperature spikes exceeding 34°C in some years by the end of the century. Such changes have profound implications for the country's socio-economic sectors, particularly in agriculture, water resources, human health, and energy demand.

## Projected Average Maximum Temperature for Malawi Policy First scenario Multi-Model Ensemble



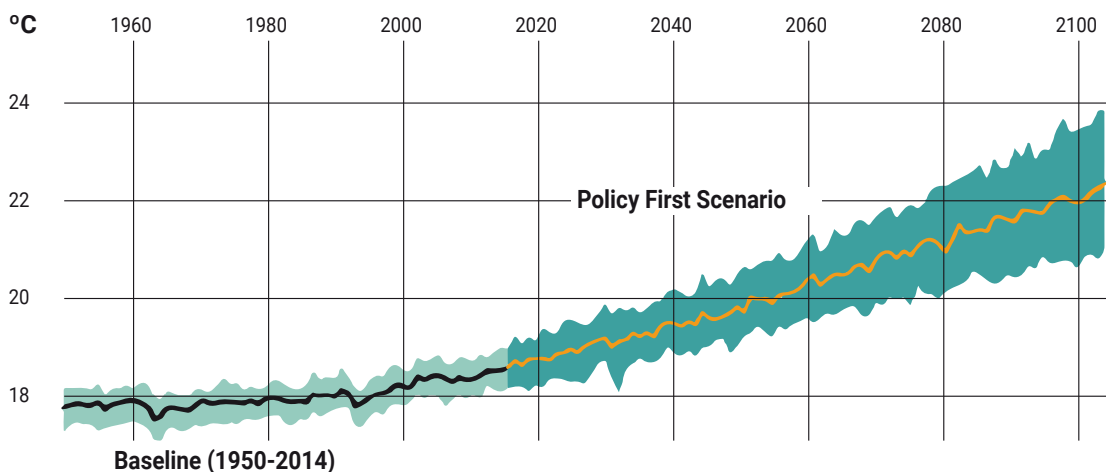
Studio ATLANTIS, 2025

**Figure 10.21:** Projected Average Maximum Temperature for Malawi under Policy First Scenario, Multi-Model Ensemble (World Bank 2022)

Under the Policy First scenario, the warming trend in temperatures is expected to accelerate, with minimum temperatures projected to exceed 22°C by the end of the 21st century (Figure 10.22). These projections indicate significant implications for agriculture, water

resources, and human health in Malawi. Rising minimum temperatures could affect crop growth cycles, increase evapotranspiration rates, and exacerbate heat stress on both human and animal populations.

## Projected Average Minimum Temperature for Malawi Policy First Scenario Multi-Model Ensemble



Studio ATLANTIS, 2026

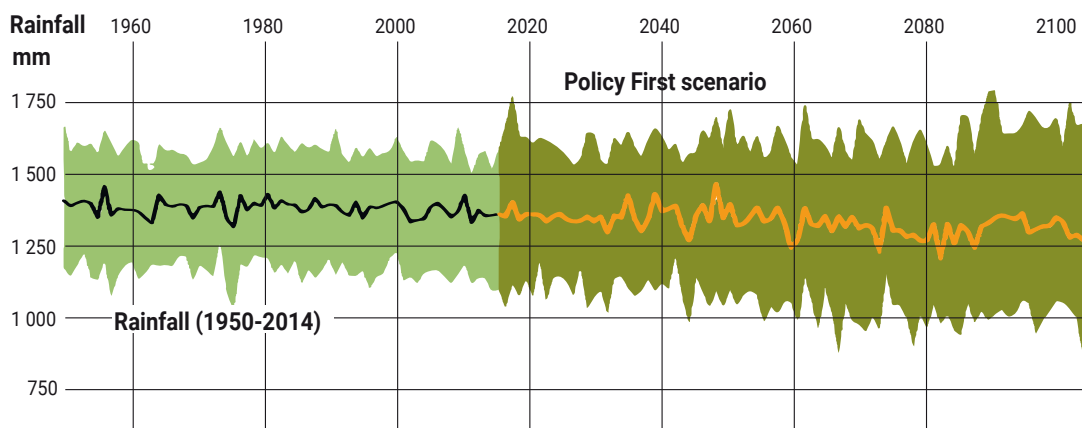
**Figure 10.22:** Projected Average Minimum Temperature for Malawi under Policy First scenario, Multi-Model Ensemble (World Bank 2022)

Under the Policy First scenario, rainfall projections suggest increasing variability with higher uncertainty in future precipitation trends. While the mean rainfall remains relatively stable, the spread of the red-shaded

region suggests a broader range of possible extremes (Figure 10.23), indicating a potential for more intense wet and dry periods.

### Projected Precipitation for Malawi Policy First scenario

Multi-Model Ensemble



Studio ATLANTIS, 2025

**Figure 10.23:** Projected precipitation for Malawi under Policy First Scenario, Multi-Model Ensemble (World Bank 2022).

Higher maximum temperatures lead to increased evapotranspiration, soil moisture depletion, and heat stress on crops. Staple crops such as maize, which is highly temperature-sensitive, experience declining yields. Increased temperatures shorten growing seasons, affecting both rainfed and irrigated agriculture.

Heatwaves and persistently high temperatures exacerbate heat-related illnesses, including dehydration, heat exhaustion, and cardiovascular diseases. Vulnerable populations, particularly elderly individuals, outdoor workers, and children, will face increased risks of heat stress. Vector-borne diseases such as malaria could expand into new areas as temperatures create favourable breeding conditions for mosquitoes.

Increased temperatures will raise electricity demand, particularly for cooling and refrigeration, straining Malawi's energy infrastructure. The higher temperatures could also reduce hydropower generation efficiency, affecting energy availability and stability.

### 10.6 Scenario 3 - Target Seeking

Under the Target Seeking scenario, Malawi employs both good governance and economic prosperity. The country is well-positioned to achieve environmental sustainability within a generation. The country becomes an upper middle-income nation with a healthy environment,

including productive land, water use efficiency, abundant ecosystem services, and clean air.

#### 10.6.1 Land and soil

Good land use practices and regulations minimize environmental degradation and boost economic growth. The Green Belt Initiative sees large areas placed under irrigation, resulting in all year intensive food production. Degraded land is restored while old irrigation schemes are properly maintained. These practices improve soil fertility through conservation. In addition, more is produced on less land because of good agricultural practices, resulting in decreased demand for virgin land. Eco-friendly infrastructures result in improved transportation and livelihoods while a greater use of renewable energy sources reduces emissions.

To mitigate the impacts of Business as Usual and Policy First scenarios, the Target Seeking scenario advocates for the following:

- **Agroforestry practices:** Integrating trees within agricultural systems to restore soil fertility and reduce erosion.
- **Intensification:** Promoting efficient use of agricultural inputs and modern techniques to enhance productivity without further degrading land.

- **Rehabilitation programmes:** Targeted restoration of degraded landscapes through afforestation, soil conservation, and watershed management.
- **Policy integration and governance:** Strengthening land tenure systems, policy enforcement,

and stakeholder collaboration to ensure sustainable practices.

As Table 10.1 shows, both annual soil erosion and sedimentation are greatly reduced under the Target Seeking scenario.

Summary: Sedimentation under the Target Seeking scenario	
Output	Range of mean annual erosion in croplands (t/ha/yr)
Results by 2050	24 – 28
Output	Range of annual sedimentation in reservoirs (Million t/yr)
Results by 2050	2.3 – 2.9

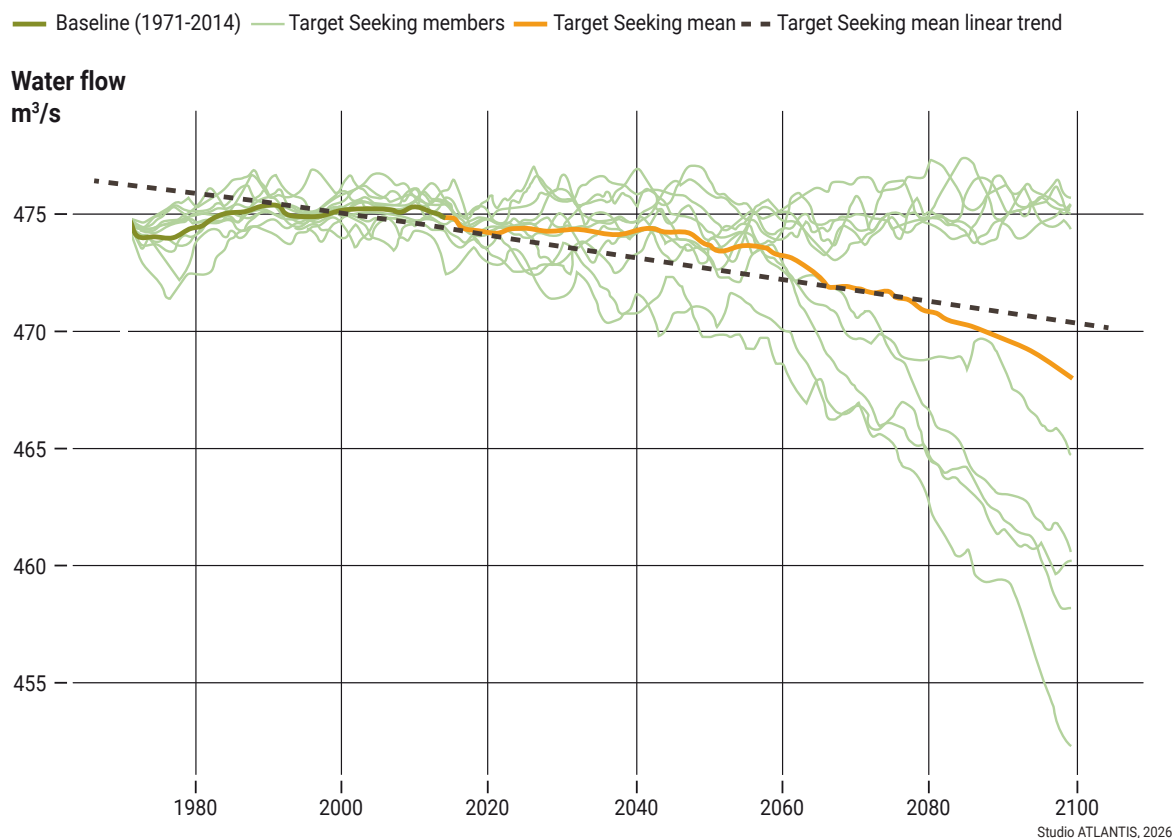
### 10.6.2 Biodiversity

Government interventions in protecting biodiversity improve ecosystem services such as pollination and carbon sequestration. These services create an enabling environment that can stabilise food production and provide sustainable livelihood. The transition to renewable sources reduces the reliance on natural biomass.

### 10.6.3 Freshwater

Emerging projections for Lake Malawi levels under the more optimistic climate and management Target Seeking scenario suggest a stabilisation and potential recovery of the lake’s water levels over time. As shown in Figure 10.24, with the right interventions and favourable climate conditions, it is possible to improve water flows into all of Malawi’s lakes.

## Projections of water levels in Malawi beyond 2060 Target Seeking Scenario



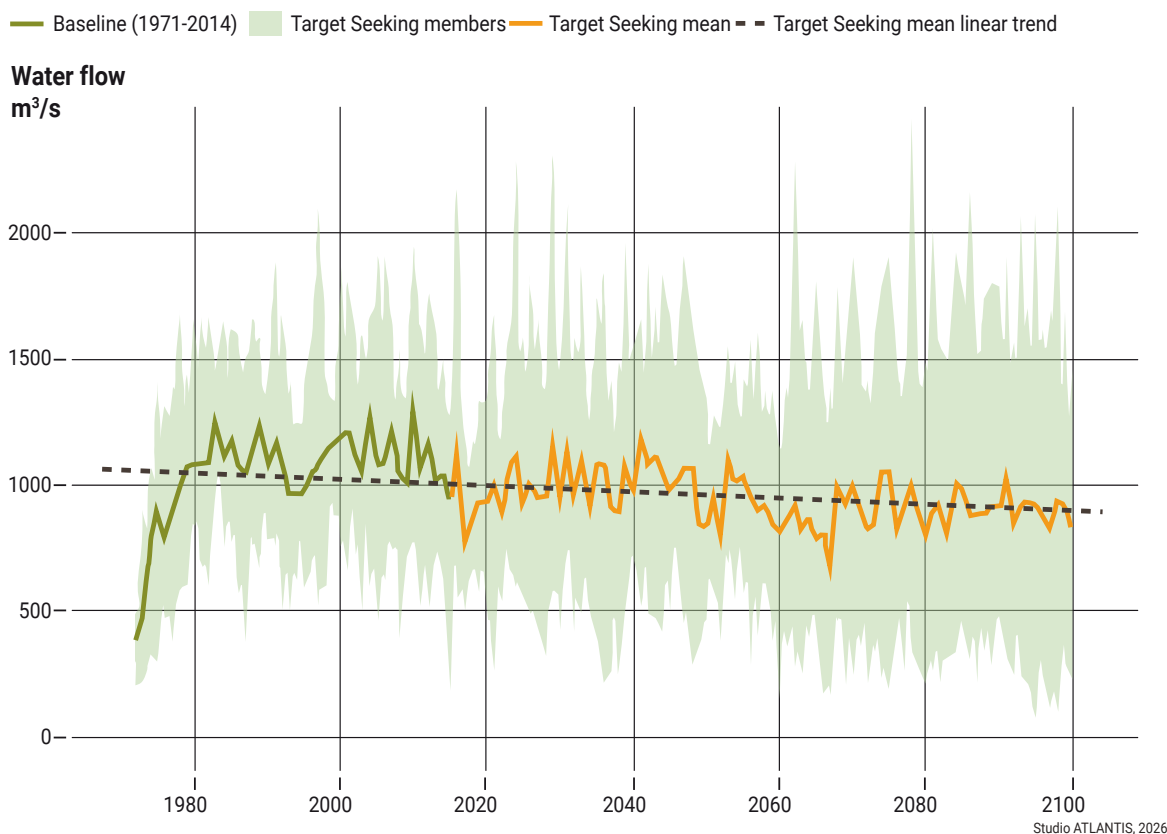
**Figure 10.24:** Projections of water levels in Malawi beyond 2060 under the Target Seeking scenario (DCCMS Database 2024)

Stabilised lake levels carry positive implications for Malawi’s socio-economic development and environmental resilience. Reliable water levels can support consistent irrigation for agriculture, directly contributing to improved food security and the commercialization of farming, especially in lakeshore districts. Hydropower generation, heavily dependent on stable outflows through the Shire River, would benefit from reduced variability, helping to secure energy supply for households and industry. Additionally, a more predictable water regime can enhance the resilience of aquatic ecosystems, fisheries, and biodiversity, thereby sustaining livelihoods and ecological functions. For economic sectors such as tourism, fishing, transport, and urban water supply, consistent lake levels mean reduced operational disruptions and improved

planning capacity. Overall, the stabilisation of Lake Malawi reinforces national efforts to build climate-resilient infrastructure and resource management systems.

Under the Target Seeking scenario, projections for inflow into Lake Malawi present a more optimistic outlook than in the other scenarios. The historical baseline average of approximately 1000 cubic meters per second (m<sup>3</sup>/s) continues to serve as a reference point. As depicted in Figure 10.25, a mean linear trajectory suggesting a generally stable inflow pattern is possible. Such stability implies that the lake may continue to receive sufficient water to balance outflows and evaporation, contributing to a more consistent hydrological regime under favourable conditions.

### Projections of inflows Malawi beyond 2060 Target Seeking scenario

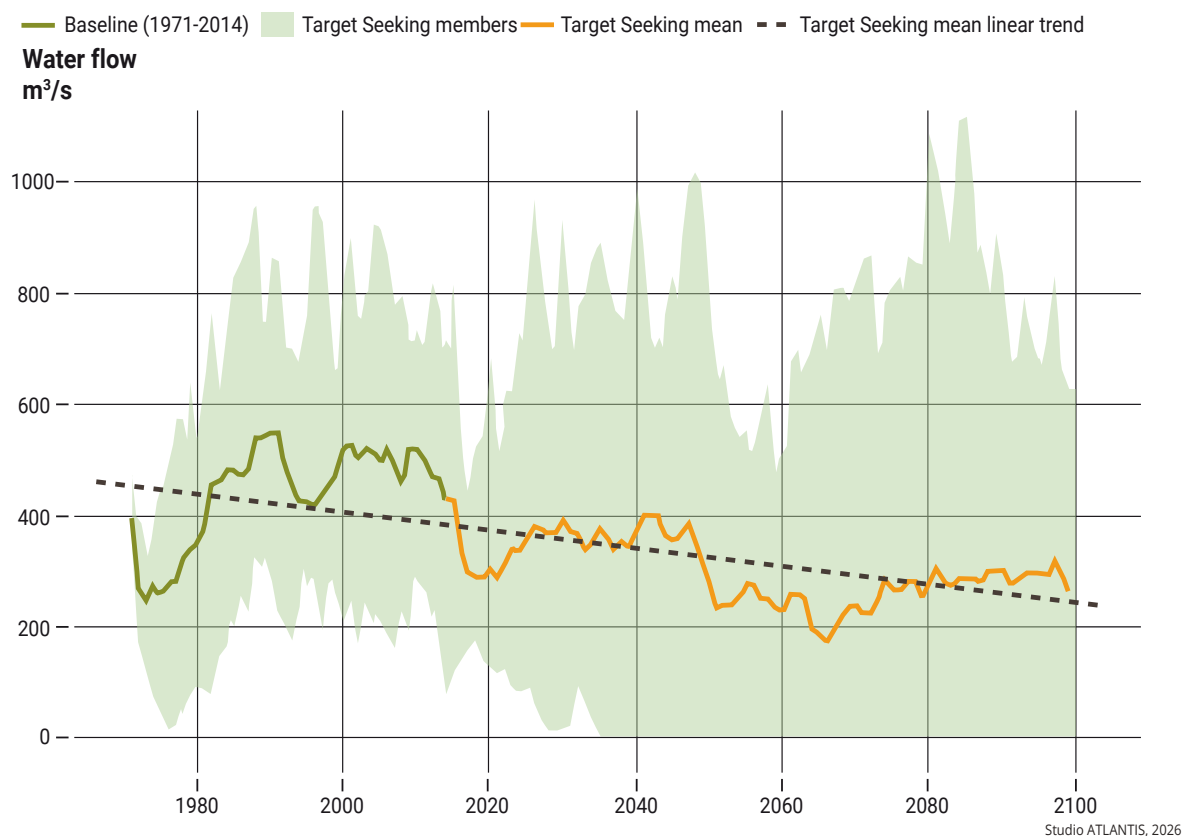


**Figure 10.25:** Projections of inflows Malawi beyond 2060 under the Target Seeking scenario (DCCMS Database 2024)

The Target Seeking scenario projections for Lake Malawi’s outflow, primarily through the Shire River, suggest a relatively stable trend throughout the 21st century, offering a more hopeful outlook compared to both the Target Seeking and Business as usual scenarios.

The historical baseline, averaging around 500 cubic meters per second (m<sup>3</sup>/s), remains a crucial reference point, and as Figure 10.26 shows, a stable linear trend in outflows is possible. This will support downstream hydrological processes.

## Projections of water outflows from Lake Malawi beyond 2060 Target Seeking Scenario



**Figure 10.26:** Projections of water outflows from Lake Malawi beyond 2060 under the Target Seeking scenario (DCCMS Database 2024)

Under the Target Seeking scenario, stable water levels up to 2060 contribute to sustained water supply, enhancing hygiene and reducing the spread of waterborne diseases such as cholera and dysentery. Investments in water infrastructure, supported by the Malawi Agenda 2063's focus on sustainable water resource management, ensure access to clean water and improved sanitation. Strengthening healthcare systems, expanding disease surveillance, and implementing adaptive water policies, such as those in the National Water Policy and the National Sanitation Policy, will be critical to managing these health risks.

Steady water levels and rising streamflow until 2060 support consistent hydropower generation, reinforcing Malawi's efforts to expand renewable energy under the Malawi Renewable Energy Strategy. However, with climate variability it is necessary that there are investments in diversified and climate-resilient energy sources. The implementation of the National Energy Policy and the Integrated Energy Plan will promote solar, wind, and bioenergy expansion; this will help mitigate climate risks. Advancements in energy storage, smart grids, and decentralised mini-grid systems will also enhance energy reliability in the face of fluctuating water resources.

A steady water supply until 2060 fosters economic growth, supports industries reliant on water, and enhances resilience in key sectors such as agriculture, fisheries, and tourism. Malawi Agenda 2063 emphasises economic diversification and industrialisation to reduce overdependence on climate-sensitive sectors. Strengthening social protection programmes, improving financial inclusion, and promoting green jobs creation can mitigate livelihood vulnerabilities.

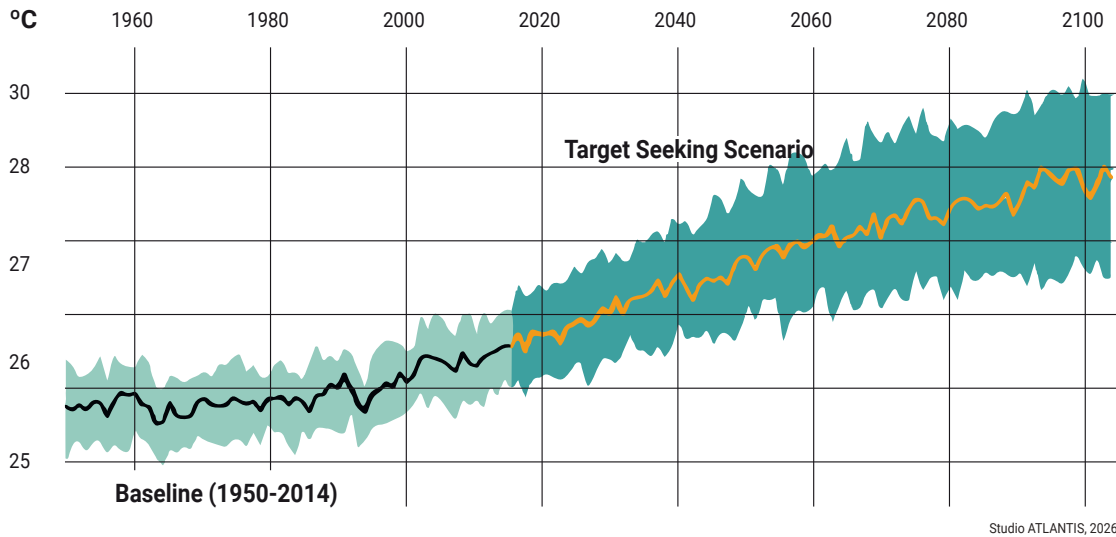
Rising streamflow post-2060 offers opportunities to expand irrigation, boosting food production and reducing dependence on rain-fed agriculture. Investments in large-scale irrigation projects, supported by the National Agriculture Policy and the National Resilience Strategy, will enhance agricultural productivity. However, variability in water availability could disrupt farming cycles, necessitating widespread adoption of climate-smart agriculture practices, such as drought-resistant crops, agroecological farming, and precision irrigation. Strengthening food storage and distribution networks will also be essential to sustain food security amid fluctuating water supplies.

### 10.6.4 Air and climate

While maximum temperatures have remained relatively stable at about 26°C, global trends will see continued

temperature increases under the Target Seeking scenario, so much that by 2100 the anomaly reaches approximately 3.5°C (Figure 10.27).

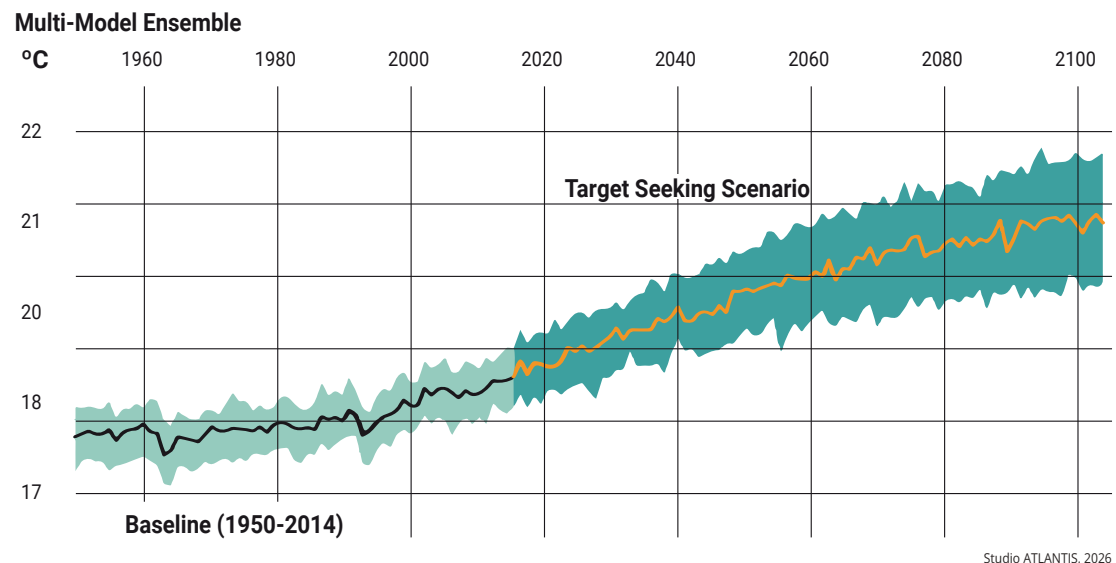
#### Projected Average Maximum Temperature for Malawi Target Seeking Scenario



**Figure 10.27:** Projected Average Maximum Temperature for Malawi under Target Seeking scenario, Multi-Model Ensemble (World Bank 2022)

The minimum temperatures have remained relatively stable at around 18°C, but are expected to increase by 3°C in line with global trends as shown in Figure 10.28.

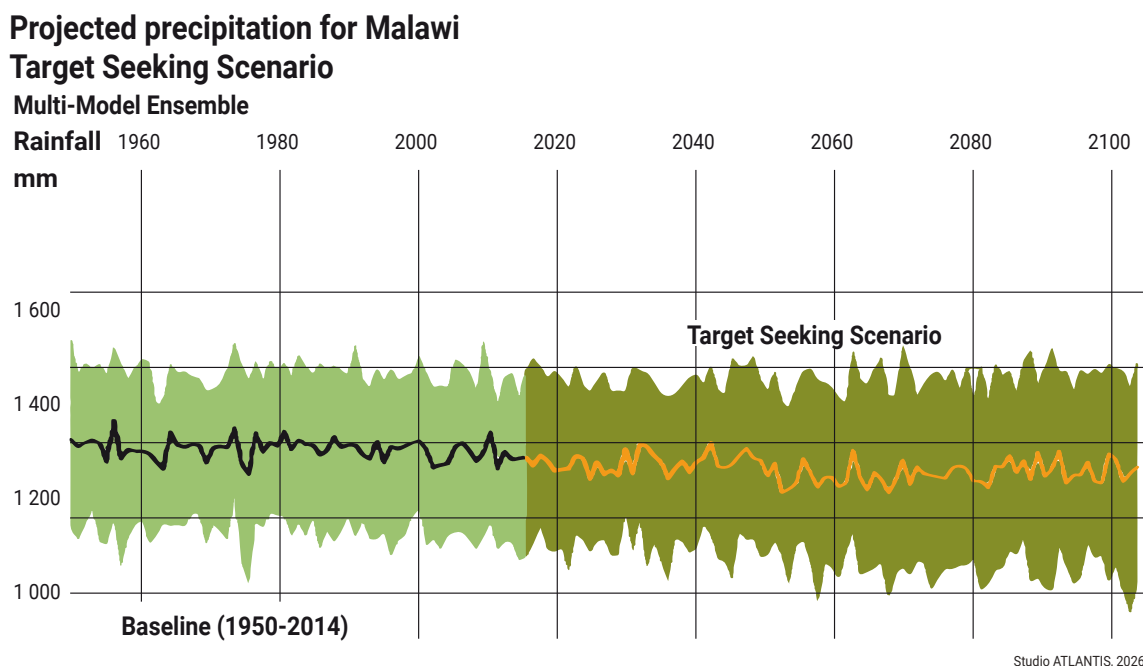
#### Projected Average Minimum Temperature of Malawi Target Seeking Scenario



**Figure 10.28:** Projected Average Minimum Temperature for Malawi under the Target Seeking scenario, Multi-Model Ensemble (World Bank 2022)

As Figure 10.29 shows, under the Target Seeking scenario, rainfall continues to fluctuate throughout the 21st century,

though with less pronounced swings than in the historical record in line with the more optimistic global trends.



**Figure 10.29:** Projected precipitation for Malawi under the Target Seeking scenario, Multi-Model Ensemble (World Bank 2022).

Moderate temperature rise under the Target Seeking scenario leads to fewer health impacts compared to the more extreme warming scenarios in Business as Usual. Improved governance, guided by Malawi Agenda 2063 and the National Climate Change Management Policy, strengthens healthcare access and resilience against climate-induced health challenges. Investments in digital health services, community-based healthcare programmes, and climate-sensitive disease surveillance systems further bolster preparedness.

As temperatures rise, energy demand for cooling needs increases. However, Malawi's push for renewable energy—through policies such as the Malawi Renewable Energy Strategy and the National Energy Policy—promotes investments in solar, hydro, and wind energy. Expansion of mini-grids and off-grid electrification enhances energy security, reducing reliance on fossil fuels while ensuring a stable power supply.

Economic diversification, underpinned by Malawi Agenda 2063's focus on industrialization and job creation, strengthens livelihood resilience. Initiatives such as the Malawi Agenda 2063's First 10-Year Implementation Plan (MIP-1) promote value addition in agriculture, mining, and manufacturing, mitigating climate-induced economic shocks and reducing forced migration and resource conflicts.

Climate-smart agriculture, supported by policies such as the National Agricultural Policy and the National Resilience Strategy, enhances food security. Investments in drought-resistant crops, precision farming, irrigation expansion, and large-scale commercial farming (mega farms) help stabilise food production despite climate variability. Enhanced market access and value chain improvements further bolster food security.

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Photo: Horst Vogel

# 11

## Options for policy actions



*Coordinating Lead Authors:* Experiencia Jalasi; Elias Gaveta

**Lead Authors:** Dick Kachilonda; Friday Njaya

**Research Fellow:** Mkhumbo Simwaka

## Executive summary

**The National State of the Environment and Outlook Report calls for a fundamental policy shift from fragmented rules to a coordinated, integrated framework that is overseen by an inter-ministerial committee operating through the environment ministry** (*well established*). Key to policy success are coordination mechanisms that are backed by systematic monitoring, enforcement, and regular reporting. Accelerating this transition will require genuine cross-sector collaboration so that environmental programmes reinforce rather than duplicate one another. The policy shift must embed a full-cycle system including clear implementation steps, and robust data collection. The institutionalisation of the reforms will tighten implementation, boost accountability, and eliminate the policy incoherence that currently blocks sustainable-development opportunities. {11.1.7, 11.2.1}

**The NSEOR calls for strong human-centred environmental policies** (*well established*). Some of the existing environmental policies exhibit significant gaps, primarily by treating environmental issues in isolation and failing to adequately link them with broader socio-economic factors such as livelihoods. For example, overemphasizing “protected areas” without linking this to the needs of the communities around is likely to result in failure. This oversight hinders a comprehensive approach, as sustainable environmental solutions must inherently support the well-being and economic stability of local communities through food security, energy access, human health and waste management, as well as with consideration for women’s empowerment. {9.17.3.2, 11.12.1}

**NSEOR calls for systemic behavioural change for sustainable development** (*well established*). While national policies provide the essential framework, true sustainability is possible when individuals, communities, industry and local councils actively embrace and implement the policy principles. One powerful approach in behavioural change lies in fostering competitive programmes and awards at the local level, such as among villages, wards, or districts. Such friendly rivalry could ignite a powerful sense of community pride and collective responsibility, translating into tangible advancements across key areas like large-scale reforestation, comprehensive waste management, enhanced community cleanliness, innovative water harvesting and irrigation systems, and the adoption of renewable energy alternatives. Empowering local leaders to establish and enforce community-specific environmental bylaws will reinforce conservation efforts at the grassroots level: for instance, laws to reduce bush fires. {11.1.1, 11.1.2, 11.1.6}

**NSEOR proposes the consolidation of the Environment and Natural Resources Management funds, diversification of revenue collection streams, and appropriation of portions of public and donor funds to the environment** (*well established*). The fund would reduce risk and incentivize critical climate initiatives, such as renewable energy deployment and emissions-reduction projects, by providing targeted financial support. Beyond cutting carbon, these investments drive economic renewal by creating high-quality jobs, promoting innovation, and driving sustainable growth. Scaling such efforts demands policy frameworks that actively lower investment barriers. In addition, the funds would support land restoration programmes and climate risk interventions in the communities and local councils. {11.1.5}

**NSEOR calls for the strengthening of collaboration between regulatory authorities; including Malawi Environment Protection Authority (MEPA), National Water Resources Authority (NWRA), and Malawi Electricity Regulatory Authority (MERA); and law enforcement entities such as the Anti-corruption Bureau and Police in the creation of a dedicated tracking system to ensure that all illegal environmental practices face thorough investigation and legal recourse** (*well established*). The integrity of environmental laws is compromised when law enforcement officers succumb to bribery, rendering them ineffective. The NSEOR advocates for good governance principles such as integrity, accountability, and the rule of law as crucial deterrents against such illegalities. A “name and shame” strategy, publicly exposing wrongdoing, is also proposed as one of the supplementary measures. {11.1.1}

**NSEOR calls for the promotion of circular economy approaches and mandatory waste recycling to mitigate environmental impacts and promote resource use efficiency** (*well established*). The policy should also include the provision of tax breaks, grants, or subsidies for entities that invest in recycling infrastructure or processes that turn waste into new products. {11.3.4, 11.3.5}

**NSEOR calls for substantial and sustained investments across the chain of environmental data collection, standardization, and access** (*well established*). This encompasses not only financial resources but also technological infrastructure, human capital, and dedicated long-term funding. This will significantly enhance the capacity to understand environmental trends. Moving beyond observations, the data will support the development of verifiable and quantifiable insights into the severity and rate of change of environmental degradation and recovery in areas such as water, biodiversity, and air quality. {11.1.4}

**Despite persistent gaps and challenges in the implementation and enforcement of its environmental policies, the nation possesses an underestimated engine for transforming its sustainability trajectory. The youthful population, abundant water resources, rich biodiversity, and land assets, together with the**

**rich Indigenous and Local Knowledge systems, provide the basis for sustainable economic growth** (*well established*). If each of these components is strategically leveraged, there is immense potential to shift the country towards a more resilient and regenerative future. {11.3}



Traditional fishing using dugout canoes is a common and sustainable practice in Malawi. Photo: Horst Vogel

## 11.1. Building on the country's aspirations

### 11.1.1 Enhancing the effectiveness of policies

#### 11.1.1.1 Issue

Although Malawi has developed numerous policies, their effectiveness is often undermined by weak enforcement, limited integration across sectors, and inadequate implementation monitoring. Current policies in areas such as water, fisheries, and forest management suffer from weak enforcement due to insufficient funding, limited institutional capacity, and overlapping mandates across sectors. For example, contradictions between irrigation, agriculture, and forest policies on wetland management hinder coherent implementation, delaying progress towards environmental goals. Addressing these gaps is essential to ensuring that policies contribute meaningfully to sustainable development and align with international frameworks, such as the Sustainable Development Goals (SDGs) and Malawi Agenda 2063.

#### 11.1.1.2 Outlook

There is a general lack of incentives for industries to use recycled content, e.g., support for medium to small enterprises engaged in recycling/upcycling and government procurement policies that prioritize recycled products. The circular economy principles of eliminating waste and pollution by design, keeping products and materials in use at their highest value, and regenerating natural systems are not fully embraced in existing policies and practices. In all the above, the country must carry out public awareness campaigns to drive demand.

Continuing with the status quo risks exacerbating environmental degradation and resource depletion. Ineffective forest management policies could exacerbate deforestation, reduce biodiversity and increase vulnerability to climate change. Poorly enforced natural resources and water management policies may fail to address over-extraction and pollution, threatening livelihoods and agricultural productivity. Enhancing the effectiveness of environmental policies requires a coordinated approach that integrates key principles, such as climate resilience, biodiversity protection, and equitable resource use, across all sectors.

#### 11.1.1.3. Possible policy options

- **Establishing a permanent inter-ministerial committee.** This body would involve representatives from key sectors and stakeholders to ensure integrated decision-making and policy coherence.
- **Strengthening the Malawi Environment Protection Authority.** Empowering the agency to evaluate and approve policies for alignment with sustainability goals would address overlaps and inconsistencies in sectoral policies.

- **Leveraging modern technology to improve policy coherence, implementation, and monitoring.** Establish a digital infrastructure for centralized data collection and storage. This may include integration of Geographic Information Systems (GIS) and data visualization tools to support monitoring policy implementation.
- **Incorporating Indigenous Knowledge:** Leveraging indigenous knowledge in policymaking would ensure that strategies are culturally relevant and locally effective.

### 11.1.2 Monitoring implementation of policies at all levels

#### 11.1.2.1. Issue

Malawi has implemented several policies guiding Environmental and Natural Resources Management, but many are not comprehensive and often lack effective monitoring mechanisms. For example, key policies such as Malawi Agenda 2063, the National Water Policy (2023), Environmental and Social Impact Assessment (2025), Seed Policy (2018), Fisheries and Aquaculture Policy (2016), and Forest Policy (2006) do not include biodiversity monitoring. Where monitoring exists, it is often weak, selectively applied, or poorly implemented. For instance, focus is largely on trees, large mammals, and fish while ignoring critical aquatic components like zooplankton, phytoplankton, and overall river health. Additionally, there is insufficient outcome tracking, lack of actionable follow-up plans, and weak stakeholder commitment. These gaps hinder the achievement of Malawi Agenda 2063 goals and sustainable development.

#### 11.1.2.2. Outlook

The absence of effective monitoring systems weakens progress toward sustainable development, as key Environmental and Natural Resources Management challenges remain unaddressed and policy impacts untracked. However, if Malawi establishes and implements comprehensive monitoring and consistent follow-up mechanisms, it can enhance conservation efforts and move closer to achieving environmental, social, and economic sustainability. At the same time, policies should promote integration of the informal waste sector by supporting registration, protective equipment provision, and partnership models that formalize and enhance their roles.

#### 11.1.2.3. Possible policy actions

- **Develop and disseminate standardized, robust monitoring tools tailored to Environmental and Natural Resources Management objectives.** Train experts to align monitoring activities with the specific goals and expected outcomes of Environmental and Natural Resources Management policies.

- **Embed monitoring responsibilities into the roles of implementing agencies.** This should include the Ministry of Natural Resources and Climate Change; Department of Environmental Affairs, Department of Forestry, Department of Fisheries, Department of Climate Change and Meteorological Services, Department of Energy; Malawi Environment Protection Authority; Ministry of Agriculture; National Council for the Environment; District Environment Subcommittees; National Herbarium and Botanic Gardens in Malawi; supporting agencies and partners, including, NGOs such as the Centre for Environmental Policy and Advocacy; development partners; academic institutions such as Lilongwe University of Agriculture and Natural Resources and University of Malawi and ensure accountability through policy evaluations.
- **Strengthen the mandate of Malawi Environment Protection Authority** to become a central oversight body to review monitoring results, recommend adjustments, and ensure continuous improvement in policy execution.

### 11.1.3. Alignment, harmonisation and integration

#### 11.1.3.1. Issue

Numerous policies critical for environmental management and sustainable development are housed under institutions that lack the mandate, expertise, or capacity to enforce them effectively (Bass *et al.* 2011). For example:

- **Weak institutional frameworks:** Policies related to mining, forestry, irrigation and fisheries are often fragmented across departments, creating overlaps and inconsistencies that hinder effective enforcement.
- **Misaligned responsibilities:** Regulatory bodies such as the Malawi Environment Protection Authority have insufficient authority or resources to oversee and align cross-sectoral policies effectively.
- **Sectoral silos:** Overlapping mandates between institutions—for instance, mining and forestry—lead to conflicts, inefficiencies, and poor coordination in implementation.

#### 11.1.3.2. Outlook

Re-institutionalizing policies could improve implementation and accountability as well as align with national policies and international development frameworks. Poorly coordinated policies may stifle opportunities for sustainable development, such as beneficiation in mining or ecotourism initiatives. Limited institutional capacity will perpetuate enforcement gaps, allowing harmful practices to persist unchecked. Communities dependent on natural resources for livelihoods will face growing hardships

as resource management policies fail to address their needs effectively.

#### 11.1.3.3. Possible policy actions

**Consolidate environmental policy management:** Empower the Malawi Environment Protection Authority as a central body that oversees all environmental and natural resource policies, ensuring coordination among ministries. Equip the agency with adequate funding, technical expertise, and data-driven tools, including those for resource mapping.

**Creation of inter-ministerial committees with clear mandates:** Develop permanent inter-ministerial committees to manage overlapping policies and ensure alignment across sectors. The committees will be composed of representatives from key ministries such as mining, forestry, agriculture, fisheries as well as non-governmental organisations, civil society groups, and the private sector for effective operationalization of the policies. Incorporate shared sustainability goals (e.g., for biodiversity protection, equitable resource use) into all sectoral policies.

### 11.1.4. Technological research, innovation and development

#### 11.1.4.1. Issue

Research and development are the set of innovative activities undertaken by corporations or government in developing new services or products (Statistics 2015). In the modern world, scientific research is essential to building the capital of knowledge for future research and technological needs. Research is important to cover invention, innovation, and diffusion of technologies which lead to new ideas that will allow improvement in existing technologies. A lot of research and new technologies are developed in research institutions and academia in an uncoordinated manner, and this results in loss of valuable information for various developmental programmes (Chukwu 2016). Well-coordinated research with appropriate data collection systems is key to good technological research and innovation. To improve implementation feasibility, a phased Research and Development plan should be adopted, starting with short-term research such as drought-resilient crops and scaling to long-term innovation in renewable energy technologies.

#### 11.1.4.2. Outlook

Technological research is the hub of innovation and development. Continuous, uncontrolled, and uncoordinated research will result in unsustainable development of the required skills and innovations key for the development of the country.

#### 11.1.4.3. Possible policy actions

Strengthen roles of the National Commission for Science and Technology as a clearing house for all the research programmes to come up with clear strategies to ensure all institutions go through the clearing house.

Technological institutions come up with a mechanism to share newly developed technologies and ensure proper monitoring of the approved technologies.

Give a mandate to the data clearing institution (National Statistics Office) to monitor data collection systems used for government decisions to ensure that decisions are made from credible data.

### 11.1.5. Integrated policy to incentivize environmental and natural resources management across sectors

#### 11.1.5.1. Issue

Although policies like The National Environmental Policy (2004), National Forest Policy (2016), and National Fisheries and Aquaculture Policy (2016) promote conservation, they lack cohesive frameworks for direct financial incentives. For example, the National Forest Policy highlights payments for ecosystem management; at the same time, the National Climate Change Management Policy (2016) mentions fiscal incentives for renewable energy, but their implementation remains limited. The National Resilience Strategy (2018-2030) acknowledges the underdevelopment of payment for ecosystem services, emphasizing the need for targeted interventions. Strengthening fiscal incentives and actionable frameworks is essential to advancing conservation efforts and achieving sustainability goals.

#### 11.1.5.2. Outlook

Incentivizing environmental and natural resources management initiatives is a key mechanism for promoting environmental conservation and sustainable resource management, as reflected in several government policies across sectors. However, the fragmented nature of these incentives, scattered across policies in different ministries, complicates effective implementation, especially given the interconnected nature of Environmental and Natural Resources Management issues.

Many individuals and communities are eager to engage in conservation efforts but lack financial support to sustain their initiatives. Providing start-up grants or small incentives could boost their motivation, foster initiative growth, and encourage broader participation, particularly among unemployed youth seeking opportunities. Harnessing this potential could accelerate Malawi's progress towards environmental, social, and economic sustainability.

#### 11.1.5.3. Possible policy actions

- **Create an integrated national policy housed under the Ministry of Finance, Economic Planning, and Development** to provide direct financial incentives, such as start-up grants and growth funding, to individuals and collectives, particularly youth, in urban, peri-urban, and rural areas.
- **The integrated national policy should prioritize initiatives that promote environmental conservation and sustainable resource management**, ensuring that economic sustainability is achieved in harmony with social and environmental goals.
- **Establish partnerships with financial institutions** to offer low-interest loans and other financial products to businesses focused on environmental conservation and sustainable resource management.
- **Incentivize these institutions through tax breaks or subsidies** to encourage investment in Environmental and Natural Resources Management related enterprises.

### 11.1.6. Smart agricultural practices

#### 11.1.6.1. Issue

Agriculture is the backbone of Malawi's economy, playing a vital role in food and nutrition security, poverty reduction, employment creation, and overall economic growth (FAO 2017). Despite its importance, the sector faces a range of interlinked challenges. Productivity remains low, and farm sizes continue to decline due to increasing population pressures (NSO 2019). The adoption of modern technologies is limited, and farming systems remain largely subsistence-based with minimal diversification beyond maize and tobacco. The sector is also highly vulnerable to climatic shocks such as erratic rainfall, dry spells, droughts, and flooding, all of which are becoming more frequent and intense due to climate change.

Additionally, poor land, soil, and water management practices contribute to further degradation of productive resources. The challenge of food loss and waste persists along the agricultural value chain, contributing not only to inefficiencies and nutritional gaps but also to greenhouse gas emissions, especially through methane release from organic waste. As a result, there is an urgent need to shift from subsistence to a market-oriented, commercial agricultural system that embraces climate-smart, technologically advanced, and environmentally sustainable approaches.

#### 11.1.6.2. Outlook

Despite these pressing challenges, there are substantial opportunities to revitalize Malawi's agricultural sector. The adoption of science, technology, and innovation presents a

strategic entry point for increasing agricultural productivity, reducing dependency on synthetic inputs, and adapting to climate variability. Climate Smart Agriculture provides a framework for integrating productivity, adaptation, and mitigation goals, helping restore degraded agro-ecosystems and build resilience.

There is potential for promoting agroforestry systems that integrate fruit, fodder, and fuelwood trees in farms, homesteads, and catchment areas. These systems not only improve soil fertility and microclimates but also offer opportunities for carbon financing through mechanisms such as REDD+ and the Clean Development Mechanism. Reforestation and improved land cover can reduce emissions and enhance watershed protection. Rainwater harvesting, conservation tillage, organic manure application, and crop diversification (including livestock and aquaculture) are other promising practices for building a resilient and diversified agricultural economy.

Further, coordinated land-use planning, which accounts for population growth and urban expansion, is necessary to ensure the sustainable development of both rural and urban land. By aligning agricultural policy with environmental, climate, water, and industrial development strategies, Malawi can create a more coherent and effective framework for sustainable agriculture.

#### 11.1.6.3. Possible policy actions

- **Strengthen the agricultural science, technology and innovation system** to address policy and institutional gaps related to environmental degradation, climate change and low technology adaptation.
- **Promote climate-smart agriculture** to scale up conservation agriculture practices, support rainwater harvesting for both smallholder and large-scale farms, and encourage agroforestry systems, as well as orchards, woodlots and homestead tree planting.
- **Enhance organic soil fertility management** by promoting the production of compost and organic manure and reduce reliance on chemical fertilizers.
- **Scale up irrigation systems** while ensuring compliance with environmental and social impact assessments and encourage small irrigation schemes in line with integrated watershed management principles.
- **Develop a national framework for land use** that balances agricultural development with urbanization and population growth trends.
- **Ensure alignment of agricultural policies** with those related to irrigation, natural resources, environment, climate change, and industrial development to promote a coordinated and holistic development approach.

## 11.1.7. Land and soil management systems

### 11.1.7.1. Issue

Land and soil are critical natural resources that sustain life, support ecosystems, and drive food security and economic development (Field 2020). Sustainable land use practices, tailored to local biophysical and socio-economic conditions, are essential for maintaining healthy landscapes, mitigating soil degradation, and addressing climate change impacts. These practices promote conservation, restore degraded land, and enhance the interactions between soil, water, livestock, and plants.

### 11.1.7.2. Outlook

With a growing population increasing pressure on land for farming and construction, involving local communities and governments through decentralized policy frameworks is vital. Collaboration with partners at the community level can improve policy integration and implementation. Sustainable land and soil management provides practical solutions to balance resource use, conserve ecosystems, and ensure long-term environmental health and productivity.

Population pressures have negatively caused declining land sizes, causing land degradation and intense soil erosion. It is important to note that sustainable land and soil management practices in situations where population is ever increasing are critical in ensuring the long-term productive potential and maintenance of various environmental functions. These are crucial in ensuring food security and economic resilience for Malawi.

### 11.1.7.3. Possible policy actions

- **Develop strategies to enhance the existing environmental education and public awareness** education policy, focusing on the impact of increased population and its effect on the environment at community, local, and national levels.
- **Strengthen policy coordination among agencies and ensure cohesive action plans** to enhance policy synergies in areas of land and soil conservation, health, and population.
- **Restore and manage some policy interventions and actions** by combining implementing fragmented policies in sustainable land and soil management to avoid conflicts in sustainable land and soil systems

## 11.1.8. Mining: community development and environmental restoration

### 11.1.8.1. Issue

Malawi is endowed with a variety of mineral resources which include gold, uranium, coal, rare earth minerals,

bauxite, limestone, and gemstones. Mining is vital to Malawi's economic growth because it offers opportunities for job creation, foreign exchange earnings, and infrastructure development (World Bank 2025). Any mining activity, whether artisanal and small-scale or large-scale, disturbs the surface of the earth which creates visual impact and environmental damage. Visual impacts on the environment can be seen in many sites where mining is taking place, such as gold mining in Kasungu and Unga River in Makanjira Mangochi and uranium mining in Karonga.

#### 11.1.8.2. Outlook

Artisanal and small-scale mining is usually carried out through labour-intensive methods and have little exploratory expertise, leaving scars or sinkholes on the landscape and polluting rivers and streams. Mining development often imposes significant environmental and social costs, including deforestation, loss of biodiversity like destruction of fish breeding sites along rivers or lakes, water pollution, and greenhouse gas emissions (World Bank 2025). Due to increased illegal mining activities, many gold mining activities in Malawi are performed along riverbanks or within rivers. Communities living near mining sites frequently face forced relocation, loss of access to natural resources, and socio-economic disruptions.

#### 11.1.8.3. Possible policy actions

- **Develop a comprehensive framework to balance the benefits of mining and large-scale development projects with their environmental and social impacts** by mandating compensatory investments in sustainable industries like ecotourism, biodiversity, and agro-ecological mega farms.
- **Develop decentralized policies and engage communities living around mining areas in sustainable mining technologies** and other mining procedures in participatory processes to enhance ownership of the resource.
- **Develop capacity-building programmes for the communities around the mining areas to ensure sustainable harvesting of the resources** and mutual restoration engagement with outsiders who come to harvest the mining resources.
- **Mandate mining companies to allocate a portion of their profits to local community development projects, such as forest management and law enforcement, waste management, and clean water systems.** Ensure transparent and equitable distribution of these funds to address community needs effectively.

### 11.1.9. Mining: environmental impact compensation and resource allocation

#### 11.1.9.1. Issue

In large-scale mining activities, the exploratory stage of mineral resources degrades the soil through vehicle traffic, drilling, and materials storage. These activities affect soil structure, mainly by compacting the soil, and soil chemistry due to petrochemical spills. Mining activities in some parts of the country, like the Livingstonia coalfield, have led to hydrogeochemical processes such as carbonate weathering, evaporation, precipitation, and acid mine drainage, which influence water quality (Wanda *et al.* 2021).

#### 11.1.9.2. Outlook

There are lots of illegal mining activities in Malawi, and this has resulted in many gold mining activities along riverbanks or within the rivers. Based on Malunga (2021), it is evident that deposits for ceramic and brick clays exist widely in Malawi which are mined through artisanal and small-scale mining activities for local use, such as lime production, pottery, and construction materials. Pollutants are also introduced into surface water bodies through mineral cleaning processes. Environmental impacts not associated with the visual aesthetics include impacts to groundwater, surface water, and the ecosystem. There is a need therefore to balance mining with ecological preservation.

#### 11.1.9.3. Possible policy actions

- **Develop an integrated strategy** that will address issues of mining and other land and soil management.
- **Develop participatory mining strategies** to ensure resource users are part of decision-making processes as a means to enhance ownership in the mining industry.
- **Develop effective enforcement mechanisms to deal with all illegal miners** regardless of level of investment (artisanal/small scale and large scale).
- **Develop effective environmental compensation and resource allocation strategies** to ensure transparency and accountability through improved monitoring.

### 11.1.10. Fisheries: decline of fish species in Malawi's water bodies

#### 11.1.10.1. Issue

Fisheries play important ecological, socioeconomic, and cultural roles in Malawi, but have largely been managed unsustainably and independently of the context in which they exist, with little to no integration in development planning, limited resource allocation, and weak overall

compliance and enforcement (Njaya 2007). While the policy discourse in managing fisheries resources changed from centralized to co-management or participatory management of resources since 1993, so far, the institutional capacity remains inadequate (Njaya 2007). This makes fisheries governance ineffective in some areas, especially with consideration of the increasing fishing pressure and climate variability. Lake Malawi has more than 800 cichlid species, of which 99 per cent are endemic to the lake, making it the most species-rich lake on earth (Malawi, Department of Fisheries 2010). The lake's fish biodiversity supports a vibrant fisheries sector that plays important ecological, socio-economic, and cultural roles.

#### 11.1.10.2. Outlook

The fisheries sector has largely been managed in an unsustainable manner due to increased number of fishers, increased amount of illegal fishing gear, and practices exerting more pressure on the fish resources. The practices include increased use of monofilament nets, threatening fish biodiversity. Currently there is inadequate monitoring and weak overall compliance and enforcement leading to illegal, unregulated, and unreported practices; limited resource allocation; and little or no consultations with the resource users. Decentralized fisheries management is yet to take shape following the recent review and approval of the fisheries decentralization policy. Combined with these factors, increasing demands for fish result in declining catches, decreasing food security, and further exacerbating poverty among fisheries dependent populations.

#### 11.1.10.3. Possible policy actions

- **Accelerate approval of the Fisheries and Aquaculture Policy** to ensure implementation at both central and local levels.
- **Develop appropriate strategies to strengthen monitoring and enforcement of fisheries activities** by engaging district councils and other stakeholders.
- **Operationalize decentralized fisheries management** to equitably ensure resource users at both local government and community levels take part in decision making processes.
- **Encourage community-based management approaches** with recognition of their local knowledge institutions, customs and by-laws approved by district councils with support from central government.

### 11.1.11. Incentives for alternative energy: Access and affordability

#### 11.1.11.1. Issue

Malawi's energy sector relies on biomass like wood fuel and charcoal, which is used by over 96 per cent of households for their cooking needs. This reliance contributes significantly to deforestation (Schuenemann 2019) and environmental degradation, health risks from indoor air pollution, and soil erosion. Despite the environmental costs, renewable energy adoption remains low, particularly among low-income populations due to high costs for the renewable energy industry. Barriers include high upfront costs of technologies such as solar or biogas. Limited financing options are another barrier, as there is minimal access to micro-loans or flexible financing. In addition, lack of market incentives for renewable energy producers and consumers results in private sector hesitancy, as investors perceive the renewable energy sector as risky due to regulatory uncertainty and limited incentives. Regulating renewable energy sources is problematic due to complex licensing processes arising from bureaucratic hurdles that discourage market entry; weak enforcement due to minimal monitoring of compliance, especially in charcoal production; and lack of standards with the absence of streamlined certification and sustainability guidelines for charcoal and energy products.

#### 11.1.11.2. Outlook

Without subsidies or affordable financing, widespread adoption of renewable energy is unlikely due to high upfront costs of renewable energy systems that remain prohibitive for most low-income households. Weak regulatory and institutional capacity that encompass often complex, unclear, or poorly enforced regulatory frameworks, will continue discouraging private investment and slowing the growth of the renewable sector. Lack of accessible financing options for consumers and small renewable energy businesses will drive away investment, while unpredictable tax policies will continue to undermine business confidence in Malawi's renewable energy market. These factors may perpetuate the over-dependence on biomass since wood and charcoal will remain the cheapest and the most accessible energy sources. Unless alternatives are made more affordable and available, this dependence will persist, further fuelling deforestation, air pollution, and soil degradation. A sustainable transition demands targeted interventions across regulation, investment, and accessibility.

### 11.1.11.3. Possible policy actions

#### **Improve access and affordability for low-income households**

- Provide targeted energy subsidies through establishing programmes that provide energy vouchers or cash transfers to low-income households to help them acquire solar home systems, improved cook stoves, or clean fuels.
- Provide affordable financing mechanisms through partnering with financial institutions and mobile money platforms to offer low-interest loans and pay-as-you-go models tailored to poor and rural communities.
- Strengthen community-based energy cooperatives by supporting locals to manage small-scale solar or mini-grid projects, enabling communal ownership and maintenance of clean energy infrastructure.

#### **Strengthen the regulatory environment**

- Provide clear and supportive regulatory frameworks by simplifying and streamlining the licensing process for renewable energy companies. Develop and communicate long-term renewable energy targets, ensuring predictable policy direction to build investor confidence.
- Provide certification for sustainable biomass through creating a simplified certification system for charcoal producers following sustainable practices. Tie certification to incentives such as market access, grants, and public recognition.
- Establish and strengthen local monitoring mechanisms to ensure compliance with energy and environmental regulations. Impose fines or production bans on communities or producers who fail to comply.

#### **Incentivize renewable energy industry development**

- Introduce tax breaks, import duty exemptions, and value added tax reductions for renewable energy technologies and green companies to reduce business costs and increase market entry.
- Support entrepreneurs and start-ups through innovation funds, research grants, and renewable energy incubators to develop context-specific, affordable solutions.
- Provide incentives to promote local manufacturing of renewable energy equipment (e.g., solar panels, batteries, stoves), creating green jobs and reducing dependency on imports.

#### **Attract climate-friendly investment**

- Establish a domestic carbon credit trading system to reward businesses for reducing emissions. Allow trade in local and international carbon markets, creating a new revenue stream for green investments.
- Issue green bonds to finance projects in renewable energy, reforestation, and sustainable agriculture. These instruments offer low risk, high impact returns and can attract both domestic and international investors.
- Create a climate resilience fund to support investments in sectors vulnerable to climate change, especially energy, agriculture, and water. The fund will also reduce financial risks for adaptation-related projects.
- Provide partial risk guarantees or insurance schemes to de-risk renewable energy investments, especially for foreign or first-time investors.

#### **Promote corporate social responsibility and private sector engagement**

- Encourage companies to invest in renewable energy and energy efficiency as part of their corporate social responsibility. Offer tax benefits or public recognition to businesses that offset their carbon footprint or engage in sustainability initiatives.
- Strengthen public-private sustainability partnerships by promoting collaboration between government, business, and NGOs to implement clean energy projects in rural areas.
- Provide green procurement and business leadership by allowing public institutions to procure energy-efficient appliances and renewable systems and encourage private sector leadership in green innovation.

#### **Institutional and capacity development**

- Train local government staff and energy officers in renewable energy management, policy enforcement, and monitoring and evaluation.
- Promote policy alignment and inter-ministerial coordination by strengthening collaboration across key ministries such as those for energy, finance, and environment to ensure harmonized policies and cross-sector implementation.
- Provide public awareness and education by launching campaigns to educate citizens on the benefits of clean energy, sustainable biomass use, and available financing options.

## 11.2. Improving quality of life

Environmental sustainability and quality of life are deeply interconnected. Environmental degradation, driven by deforestation, climate change, unsustainable land use, and overdependence on biomass for energy, has increasingly compromised the health, livelihoods, and resilience of communities. This does not only weaken ecosystem services but also undermines socio-economic progress, exacerbating poverty and inequality. A sustainable environment is foundational to human well-being, ensuring access to clean air, water, food, and energy while safeguarding opportunities for future generations.

### 11.2.1. Policies for women's empowerment and inclusive development: Access to energy sources.

#### 11.2.1.1. Issue

Women disproportionately bear the impacts of environmental challenges, particularly in energy access, water collection, and agricultural labour. They are primarily responsible for gathering firewood, cooking, and water collection, tasks that consume significant time and expose them to health and safety risks. According to the Malawi Energy Policy (2018), about 96 per cent of households rely on biomass, mainly firewood and charcoal, for cooking. This reliance not only drives deforestation but also affects women's health due to indoor air pollution and limits their time for education, income-generating activities, and participation in community decision-making.

#### 11.2.1.2. Outlook

Empowering women through inclusive energy access has the potential to transform households and communities. Gender-responsive energy policies would reduce women's domestic workload, improve health outcomes, and unlock economic opportunities in clean energy entrepreneurship, agro-processing, and education. When women are actively involved in environmental governance and green value chains, their inclusion supports both environmental sustainability and equitable development. Taking these actions can lead to greater resilience, reduced poverty, and increased community cohesion.

#### 11.2.1.3. Possible policy actions

- **Subsidize clean cooking and off-grid solar solutions for women-led households.** Introduce targeted subsidies or microfinance schemes to increase the affordability of clean cooking stoves and solar home systems for women in rural areas.
- **Establish women's green energy cooperatives and training hubs.** Promote the formation of women's cooperatives that focus on the distribution, maintenance, and retail of renewable energy technologies, particularly solar lighting and irrigation systems.

- **Strengthen coordination between the Ministry of Gender and the Department of Energy** to ensure that all rural electrification and energy transition projects are designed with women's priorities in mind.
- **Quantitative gender targets should be included,** such as increasing women's access to clean energy solutions by 30 per cent by 2030 and ensuring that 40 per cent of beneficiaries of climate resilience programmes are women.

### 11.2.2. Waste management: recycling, biodegradable materials, and waste-to-energy

#### 11.2.2.1. Issues

Malawi's waste management system remains underdeveloped, with poor collection and disposal services in many areas. Solid waste is disposed of in open landfills or burned, leading to environmental pollution, public health risks, and the release of greenhouse gases. In 2010, the focus was on improving general waste collection and disposal, but the scope needs to be expanded to include more sustainable waste management practices that prioritize and incentivize recycling and reducing waste at the source.

#### 11.2.2.2. Outlook

Sustainable waste management is a key element of both the circular economy and efforts to mitigate climate change. Countries across Africa are adopting waste-to-energy technologies, landfill regulations, and enhanced recycling systems. For Malawi, improving waste management not only addresses environmental pollution but also presents opportunities for creating energy from waste and promoting resource efficiency.

#### 11.2.2.3. Possible policy actions

- **Develop a national strategy focused on reducing waste generation at the source and improving recycling rates.** This policy should include measures such as mandatory recycling for businesses, as well as penalties for non-compliance. The strategy should also incentivize the use of biodegradable materials and reduce reliance on single-use plastics.
- **Invest in and incentivize waste-to-energy technologies that convert solid waste into electricity or energy briquettes.** Such facilities reduce landfill pressure and provide renewable energy. Malawi can benefit from adopting such technologies, particularly in urban centres where waste generation is highest.

### 11.2.3. Food security

#### 11.2.3.1. Issue

Food security in Malawi is increasingly threatened by environmental degradation, erratic weather patterns, and declining soil fertility. Smallholder farmers produce over 80 per cent of the country's food and face challenges such as prolonged droughts, floods, and land degradation, which reduce crop yields and livestock productivity. This instability undermines nutrition, health, and livelihoods, particularly for vulnerable groups including women, children, and people in rural areas. The use of unsustainable farming practices and the overdependence on maize as the staple crop further increases exposure to food insecurity during shocks.

#### 11.2.3.2. Outlook

If Malawi integrates environmental sustainability into its food systems, it can achieve greater food stability, improved nutrition, and economic resilience. Sustainable agricultural practices such as agro-ecology, conservation agriculture, and climate-smart farming can restore degraded land, improve yields, and enhance resilience to climate change. Furthermore, diversifying food sources and strengthening local food systems can reduce reliance on maize and external aid during crises. Aligning food security strategies with environmental management offers a pathway to long-term human development.

#### 11.2.3.3. Possible policy actions

- **Promote climate-smart agriculture through incentives and extension services.** Expand investment in agro-ecology, conservation agriculture, and climate-smart farming by aligning these practices with input subsidy programmes and strengthening agricultural extension support.
- **Promote value chain development for underutilized, climate-resilient crops** such as millet, sorghum, pigeon peas, and sweet potatoes by creating opportunities in production, processing, fortification, and market access. These efforts should integrate climate adaptation strategies and nutrition goals to enhance food security and diversify rural livelihoods.

### 11.2.4. Food security and health resilience

#### 11.2.4.1. Issue

Malawi's food systems are increasingly vulnerable to climate change and environmental degradation. The country relies heavily on rain-fed agriculture, making it particularly susceptible to erratic rainfall, droughts, and floods. For example, the 2015–2016 El Niño-induced drought left over 6.5 million people food insecure. Monocropping, deforestation, and soil degradation further threaten agricultural productivity and resilience.

At the same time, access to diverse and nutritious food remains low. Malnutrition persists, with stunting affecting 37 per cent of children in the country (United Nations Children's Fund (UNICEF 2018).

Environmental risks also contribute to poor health outcomes. Contaminated water sources, indoor air pollution from biomass fuel, and inadequate sanitation increase exposure to diarrhoeal diseases and respiratory infections. Climate-sensitive diseases such as malaria and cholera are also on the rise, particularly during floods and heatwaves.

#### 11.2.4.2. Outlook

Without integrated strategies, climate-induced crop failures will continue to undermine food availability, pushing households into deeper poverty and worsening malnutrition. Health systems will remain overburdened, and environmental degradation will erode the natural capital upon which food security depends. Malawi's efforts to meet SDG 2 (Zero Hunger) and SDG 3 (Good Health and Well-being) will be significantly constrained.

#### 11.2.4.3. Possible policy actions

To strengthen food security and health resilience, Malawi must adopt a systems approach linking agriculture, environment, and public health. Key actions include:

- **Expand climate-smart agriculture.** Promote drought-tolerant crops (e.g., sorghum, pigeon peas, sweet potatoes), conservation agriculture, and irrigation scheduling.
- **Invest in agro-ecology.** Support farmer field schools and indigenous knowledge in soil fertility restoration, intercropping, and pest control without harmful chemicals. Agro-ecological zones such as the Shire Highlands show promise for upscaling sustainable intensification.
- **Link food systems to nutrition and health policies.** Integrate nutrition-sensitive agriculture into national nutrition policies and local extension services. Promote local foods through school feeding programmes and public procurement to diversify diets and reduce micronutrient deficiencies.
- **Enhance cross-sector coordination.** Establish district-level food and health task forces that include agriculture, health, and environmental officers to co-plan interventions, particularly in disaster-prone regions.

## 11.3. Leveraging on Malawi's strengths

### 11.3.1. Water availability: Water management systems and incentives for efficient use

#### 11.3.1.1. Issue

Water management is critical for sustainable development in Malawi, particularly given the increasing pressures of climate change and population growth. Inefficient water uses in agriculture, inadequate water harvesting systems, and limited access to safe drinking water pose major challenges to the country's water security. To address these challenges, the government must implement policies that promote efficient water use and water harvesting, as well as enhance access to clean water.

#### 11.3.1.2. Outlook

Malawi possesses significant freshwater resources in large bodies such as Lake Malawi, Lake Malombe, Shire River, Lake Chirwa, Chia Lagoon, and numerous river networks (Mulwafu 2002), and yet the country faces water management challenges. Despite this natural endowment, the country is classified as water-stressed primarily due to rapid population growth, environmental degradation, rural poverty, unsustainable usage patterns, and poor agricultural and forestry practices (Malawi, Ministry of Natural Resources and Environmental Affairs 2004; Malawi, Ministry of Natural resources, Energy and Environment 2010). These pressures have resulted in frequent disease outbreaks, repeated famines (Msilimba and Holmes 2005), biodiversity loss, increasing water scarcity, and water use conflicts. At Chia Lagoon, pollution, salinisation, and weed invasion reflect inadequate management strategies (Bunderson 2008). The Malawi government has responded by implementing several legal frameworks, including the Environmental Management Act (2017), Forestry Policy (1997), Land Policy (2002), Water and Sanitation Policy (2006), and National Water Policy (2005) (Makwinja 2019), but these approaches predominantly centralise control with the state while overlooking the importance of public participation.

Malawi has also made limited progress with water management incentives, with most existing mechanisms focusing on urban water pricing structures that attempt to promote conservation but remain controversial and ineffective. The establishment of Water User Associations in rural areas provides some community-based incentives for sustainable management, but these suffer from inconsistent implementation and inadequate financial support (Aarnoudse 2018). Recent pilot programmes exploring Payment for Ecosystem Services in watershed areas show promise but lack the scale needed for national impact (Facility 2014). Agricultural water efficiency subsidies for drip irrigation systems exist but reach only a small percentage of farmers, highlighting the significant gap between policy intentions and practical implementation of incentive systems across the country.

Furthermore, restoration efforts for Malawi's aquatic ecosystems have been consistently undermined by budget limitations and disagreements regarding both the severity of problems and the most appropriate policy solutions, highlighting the fundamental tension between the country's limited water resources and the growing demands of its population and economy (Makwinja 2019). This highlights the importance of reviewing existing policies to ensure that their provisions adequately address policy deficiencies and conflicts.

#### 11.3.1.3. Possible policy actions

- **Subsidies for water harvesting technologies.** The government should provide subsidies or grants for water harvesting technologies, such as for rainwater tanks, to households and farmers. This will promote water conservation, particularly in drought-prone areas, and ensure a reliable supply of water for agriculture and domestic use.
- **Promote efficient irrigation systems.** Encouraging farmers to adopt water-efficient irrigation systems, such as drip irrigation, through subsidies or tax breaks will reduce water wastage in agriculture. The government could also offer technical support and training programmes to help farmers implement these systems effectively.

### 11.3.2. Indigenous Knowledge Systems

#### 11.3.2.1. Issue

Indigenous and local knowledge has long been an integral part of local communities in Malawi, particularly in agricultural practices, water management, and biodiversity conservation. However, this knowledge is often marginalized in formal policy frameworks, despite its potential to contribute to sustainable development. Indigenous communities hold valuable insights on climate adaptation, traditional resource management, and biodiversity that can strengthen national policies.

Indigenous knowledge is increasingly recognized globally as a critical resource for environmental sustainability. Leveraging this knowledge can enhance Malawi's resilience to climate change and environmental degradation by applying centuries-old, locally developed practices.

#### 11.3.2.2. Outlook

Neglecting indigenous and local knowledge risks the erosion of practical, place-based environmental knowledge passed down through generations. This weakens community ownership and undermines effective monitoring and resilience. For example, community-based water quality monitoring using sensory cues, such as water taste, changes in animal presence, and flow patterns, remains unrecognized in formal water quality

assessments. Likewise, bypassing traditional custodians in water infrastructure planning results in resistance, poor maintenance, and diminished social cohesion.

#### 11.3.2.3. Possible policy actions

- **Formal integration of indigenous knowledge into national policies.** Establish formal mechanisms that incorporate indigenous and local knowledge into national policies for agriculture, biodiversity conservation, and water management. This could involve setting up an advisory committee that includes indigenous leaders and knowledge holders, ensuring that such knowledge informs national strategies.
- **Indigenous knowledge research and documentation.** Launch a national research initiative to document and preserve indigenous knowledge related to natural resource management. This initiative could be run in collaboration with universities, research institutions, and local communities to create a comprehensive database of indigenous practices.
- **Education and training programmes on indigenous knowledge.** Develop programmes that teach both rural and urban communities about the value of indigenous practices in sustainability, including climate-resilient farming, sustainable water usage, and conservation. These training sessions can help bridge the gap between traditional and modern approaches to resource management.

#### 11.3.4. Youth as a demographic dividend

##### 11.3.4.1. Issue

Malawi's population is overwhelmingly young, with approximately 67 per cent under the age of 25 (UNFPA 2025). However, youth unemployment remains persistently high, estimated at over 23 per cent, and underemployment is even more widespread. Most young people lack access to formal employment, especially in rural areas, and few are equipped with skills relevant to the emerging green economy (Benson and Baulch 2019). Opportunities in sectors such as renewable energy, sustainable agriculture, waste recycling, and eco-tourism are growing but remain largely untapped by the youth due to limited exposure, training, and financial access.

##### 11.3.4.2. Outlook

If this demographic challenge is not addressed, it could exacerbate poverty, social unrest, and environmental degradation. However, with the right support, Malawi's youth can become a driving force behind sustainable development. Young people bring creativity, energy, and adaptability, qualities essential for innovation in climate-smart technologies, conservation entrepreneurship, and digital environmental solutions. Globally, youth-led

innovations are transforming the green economy, and Malawi has the potential to replicate such models locally.

##### 11.3.4.3. Possible policy actions

To harness youth as a demographic dividend, Malawi needs to prioritize the following actions:

- **Expand vocational training in renewable energy systems (e.g., solar installations and biogas), sustainable agriculture, eco-tourism, and eco-construction** through partnerships with Universities, the Technical Entrepreneurial and Vocational Education and Training Authority, and local technical colleges.
- **Establish regional youth innovation hubs to serve as training, co-creation, and incubation centres.** These hubs can host climate action labs, green design challenges, and promote research into local sustainability solutions.
- **Promote youth engagement in policy-making and environmental governance,** including involvement in Village Natural Resources Management Committees, youth environmental clubs, and national green campaigns.

#### 11.4 Monitoring, evaluation, and learning

A dedicated monitoring, evaluation, and learning framework will accompany policy implementation. Indicators can be drawn from the Sustainable Development Goals, Nationally Determined Contributions targets, and Malawi's national development strategies. Quarterly progress reports, third-party audits, and adaptive learning loops will guide course corrections. An integrated analysis should be included in the project appraisal to clarify the content and process for project review purposes, while considering institutional options that ensure the intervention is transparent.

#### 11.5. Conclusion

Malawi stands at a critical point where environmental degradation, climate vulnerability, and socio-economic pressures converge to challenge sustainable development. A range of integrated policy options is possibly rooted in the country's development aspirations, existing institutional frameworks, and local strengths. The key to unlocking environmental sustainability and resilience lies in policy coherence, inclusive governance, and the strategic mobilization of Malawi's unique assets such as its indigenous knowledge systems, abundant freshwater resources, and youthful population.

A cross-sectoral analysis reveals that fragmented institutional mandates, weak enforcement, and limited implementation capacity continue to undermine the effectiveness of environmental and natural resource

management policies. To address these challenges, Malawi needs to pursue a systems approach that harmonizes policies across agriculture, energy, mining, fisheries, and water sectors anchored in robust data systems, inter-ministerial coordination, and community engagement. Technological innovation, climate-smart agriculture, sustainable land and water management, and the promotion of alternative energy systems present concrete pathways for advancing Malawi's environmental and socio-economic goals. Also important is the empowerment of marginalized groups, especially women and youth, through access to resources, decision-making platforms, and green economic opportunities.

Achieving the objectives outlined in Malawi Agenda 2063 and related global commitments such as the Sustainable Development Goals requires bold, inclusive, and adaptive environmental governance. The implementation of the policy options recommended in this chapter will not only restore ecological integrity but also enhance food security, public health, and livelihoods. Malawi's future depends on the urgent alignment of political will, financial resources, and citizen participation to transition towards a just, climate-resilient, and environmentally sustainable society.



Emerging and persistent environmental problems such as plastic waste require adjustments in policies and people's behaviour. Photo: MEPA

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Protection Authority acknowledges the contributions made by many individuals and institutions to the preparation and publication of this report and its Summary for Policy Makers. Special thanks are extended to:

## Government Multistakeholder Advisory Group

Prof. Ishmael Kosamu  
Ms. Karen Price  
Mr. Lyson Kampira  
Dr. Mary Shawa

Mr. Siphon Billiat  
Dr. Yanira Ntupanyama  
Ms. Yasinta Ganiza

## Scientific Advisory Group

Mr. Charles Mkoka  
Prof. Elenimo Billiat Khonga  
Mrs. Elina Kululanga

Dr. Godfrey Ganizani Mvuma  
Prof. Sosten Chiotha  
Mrs. Tamara Tamara (Mataka)

## Co-chairs

Dr. Lucy Mtilatila  
Dr. Zacharia Magombo

## Coordinating Lead Authors

Dr. Babra Ntapara  
Prof. Bryson Nkhoma  
Dr. Daniel Sikawa  
Dr. Dyson Moses  
Dr. Elias Peter Mwakilama  
Dr. Elias Gaveta  
Dr. Elizabeth Bandason  
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Dr. Experiencia Madalitso Jalasi  
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Dr. Isaac Tchuwa  
Dr. Ivy Sichinga-Ligowe  
Prof. Judith Kamoto  
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Dr. Letson Yoyola Phiri  
Dr. Maggie Munthali  
Dr. Margaret Kunje  
Mr. Masautso Guardwell Wachepa  
Dr. Miriam Joshua  
Dr. Tiwonge Mzumara-Gawa

## Lead Authors

Dr. Brighton Austin Chunga  
Dr. Chandiona Munthali  
Mr Charles Kapachika  
Dr. Dalitso Kafumbata  
Dr. Daniel Jamu  
Dr. Dick Kachilonda  
Dr. Friday Njaya  
Mr Vitumbiko Emmanuel Chirwa  
Miss. Glory Angel Muva  
Mr. Hope Baxter Chamdimba  
Mr. Hussein Milanzi  
Dr. Jean Mtethiwa

Mr. Jeremot Masoambeta  
Mr. John Mnyehere Keystone Chipeta  
Dr. Junice Dzonzi  
Ms Keeness Mang'anda  
Mr KEFASI JEREMIAH KAMOYO  
Mr. Leonard Nyanjagha  
Mr. Malazi Mkandawire  
Dr. Kennedy Chifundo Adamson  
Ms. Patricia Gomani  
Mr Samuel J. Gama  
Miss. Tamara Chirwa

## Fellows

Mr. Chiyembekezo Phiri  
Mr Aimloss Greyfield Banda  
Mr Happy Mphande  
Mr. Upile Hassan  
Miss Mphatso Ganisyeje

Mr. Latwiwif Yahya Malemia  
Miss. Malango Kayira  
Mr. Justin Ng'ambi  
Mr Richard Moyo  
Ms Khumbo Simwaka

## Communications Services Support

Mr. Aston Gondwe  
Mr. Moses Michael Phiri

## Indigenous and Local Knowledge Experts

Ms. Alice Zion Kammwamba  
Ms. Chisomo Basikolo

## Reviewers of the National State of the Environment and Outlook Report

### FOD REVIEWERS LIST

Joseph Kalowakamo  
Shaneel Chandra  
Tamiru Abiye  
Kilian Christ  
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Dr. Fabiano Thulu  
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Dr. Wilfred Kadewa  
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Carina Thomassen  
Mrs. Elinor Kululanga

## The Malawi National State of the Environment and Outlook Report Production Team

### Core Task Team

Dr Martino Mazinga  
Mr. Taylor Christian Blair  
Mr. Aubren Chirwa  
Ms. Tsork Kumcheza  
Mr. Clever Mafuta

Mr. Sandor Frigiyik  
Mrs. Caroline Kaimura  
Ms. Muthoni Kangethe  
Mr. Philip Mugisha  
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Mr. Clement Tikiwa

Mr. Benon Yassin  
Mr. Hastings Banda  
Ms. Getrude Jeke  
Ms. Takondwa Mwamadi  
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Ms. Elena van Doorn

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Dr. Chikumbusko Chiziwa Kaonga

Mr. Mzati Nkolokosa



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